FEBRUARY 1952

PRECISION METAL MOLDING

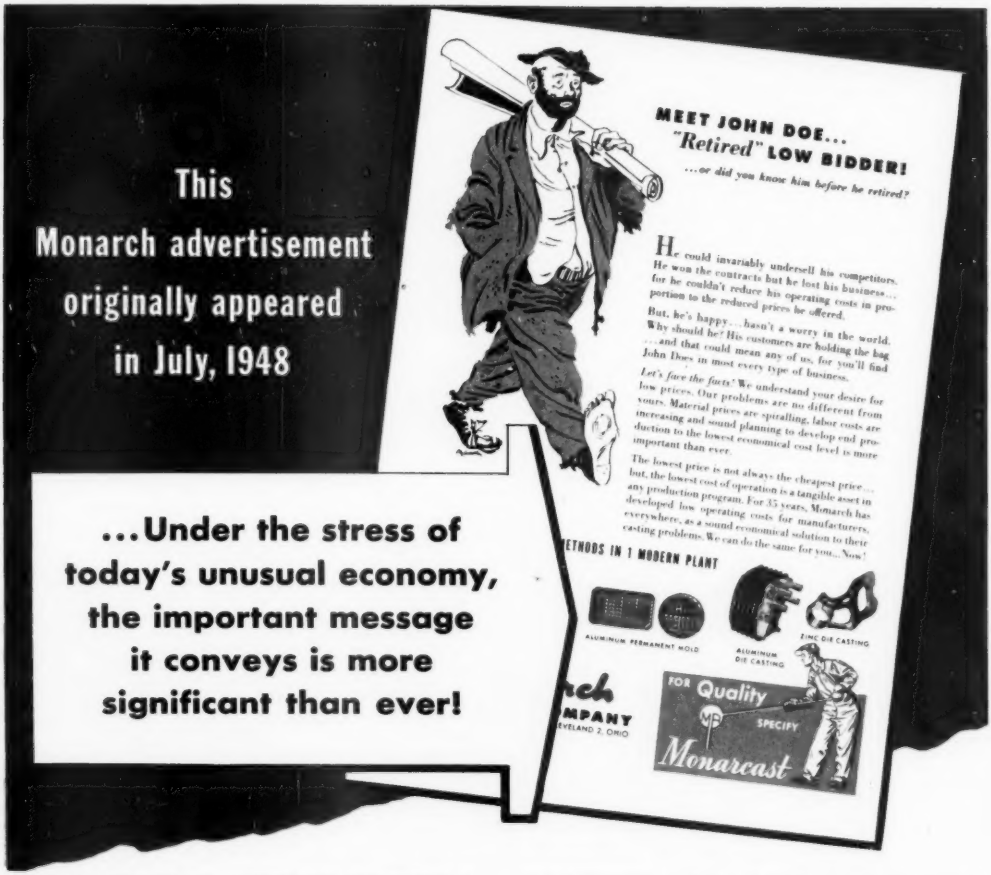
INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS
INVESTMENT CASTINGS
POWDER METALLURGY
PERMANENT MOLD CASTINGS
PLASTER MOLD CASTINGS

PMM

DESIGN • MANUFACTURE • FINISHING • USE

This Monarch advertisement originally appeared in July, 1948

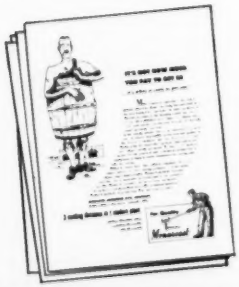

MEET JOHN DOE...
"Retired" LOW BIDDER!
...or did you know him before he retired?
He could invariably undersell his competitors. He won the contracts but he lost his business... for he couldn't reduce his operating costs in proportion to the reduced prices he offered.
But, he's happy... hasn't a worry in the world. Why should he? His customers are holding the bag ...and that could mean any of us, for you'll find John Does in most every type of business.
Let's face the facts! We understand your desire for low prices. Our problems are no different from yours. Material prices are spiralling, labor costs are increasing and sound planning to develop end production to the lowest economical cost level is more important than ever.
The lowest price is not always the cheapest price... but, the lowest cost of operation is a tangible asset in any production program. For 35 years, Monarch has developed low operating costs for manufacturers everywhere, as a sound economical solution to their casting problems. We can do the same for you... Now!
ETHODS IN 1 MODERN PLANT
ALUMINUM PERMANENT MOLD
ALUMINUM DIE CASTING
ZINC DIE CASTING
FOR Quality SPECIFY Monarcast

...Under the stress of today's unusual economy, the important message it conveys is more significant than ever!

RELIABILITY OF SUPPLIER SOURCES is one of the most important elements in any successful program of industrial production. Today's "guns and butter" economy proves it.

With 38 years of experience to call upon, Monarch is in an outstanding position to help any company whose current production requirements include aluminum permanent mold, aluminum or zinc die castings or complete sub-assembly work.

Monarch is ready to serve you now...with modern facilities and processes and people specially trained to provide practical solutions to industry's most complex casting problems.



Upon request, we'll send the complete "1948 series" of advertisements...also your copy of Monarch's FACT-FILE for design, production and purchasing executives.

MONARCH ALUMINUM MFG. COMPANY • *Detroit Avenue at West 93rd Street, Cleveland 2, Ohio*

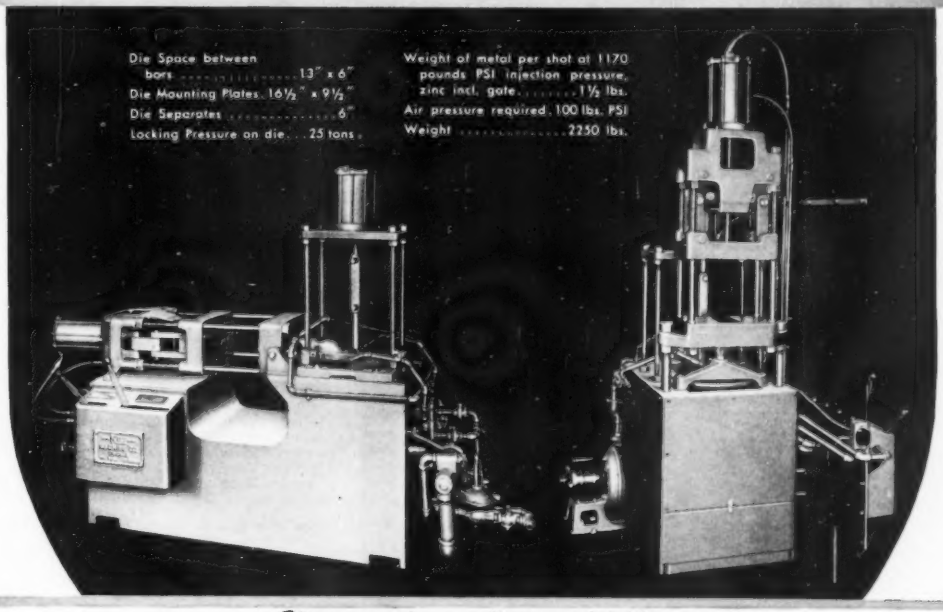
For additional information circle No. 37 on the Reader Service Card.

KUX

The Mighty MIDGET of Die Casting Machines

THE NEW KUX MODEL K

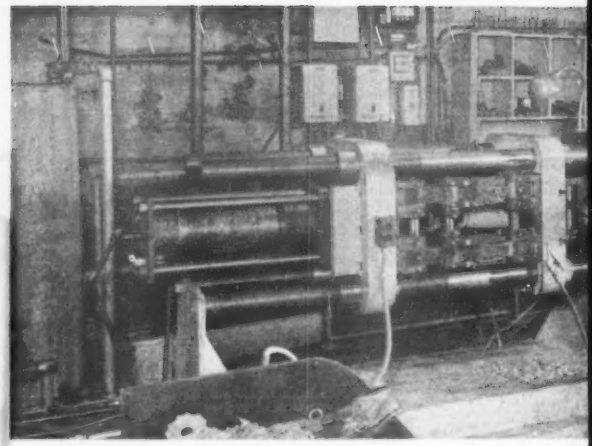
is the safest, most highly productive small die casting machine on the market! Available in horizontal or vertical center shot models, die castings weighing up to 1½ pounds in zinc are produced under high injection pressures, insuring quality, dense castings with minimum porosity. ***Compare these features:*** Center shot operation with floating nozzle always in seated contact with the die and one-piece gooseneck. Speed and power obtained by use of an air compressor to operate opening and closing of die, and metal injection plunger. Double safety lock, mechanical-electrical, prevents metal shot while die is in open position. Double toggle mechanism locking in two directions absorbs all locking pressures, operates on all four corners of die plate. Built-in ejector plate for positive ejection. Self-contained gas or oil firing unit.


Die Space between bars ..... 13" x 6"
Die Mounting Plates 16½" x 9½"
Die Separates ..... 6"
Locking Pressure on die . . . 25 tons
Weight of metal per shot at 1170 pounds PSI injection pressure, zinc incl. gate ..... 1½ lbs.
Air pressure required 100 lbs. PSI
Weight ..... 2250 lbs.

Write now for an illustrated folder

KUX MACHINE COMPANY

6725 N. RIDGE • CHICAGO 26, ILLINOIS



PYDRAUL SAVES LIVES

Officials and employes of Smith-Johnson Corporation, Los Angeles, are glad the company switched to Pydraul F-9, Monsanto's nonflammable-type hydraulic fluid.

A line leak caused Pydraul F-9 to be sprayed over the area of a die casting machine and zinc melting pot. There was no flash . . . no fire.

Although the operator of the machine was drenched and fluid was sprayed on about a half dozen men who were observing his job, no one was seriously injured.

You can switch to safe, efficient Pydraul F-9 simply by draining your present fluid and refilling. For details, contact the nearest Monsanto Sales Office or MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1749-A South Second St, St. Louis 4, Mo.

Pydraul: Reg. U. S. Pat. Off.

PYDRAUL

MONSANTO
CHEMICALS — PLASTICS

Serving Industry . . . Which Serves Mankind

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto Canada Limited, Montreal.

For additional information circle No. 38 on the Reader Service Card

FEBRUARY 1952
Vol. 10 No. 2

PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • POWDER METALLURGY
PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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Executive Vice-President

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All communications should be addressed to PRECISION METAL MOLDING, 1240 Ontario St., Cleveland 13, Ohio. Phone SUperior 1-9622. AT&T Teletypewriter No. CV-233.

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Fleet St.
London, E. C. 4, England
Telephone: City 4815

ABC

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Published monthly by the TECHNICAL PUBLISHING COMPANY, an affiliate of INDUSTRIAL PUBLISHING COMPANY, publishers of APPLIED HYDRAULICS, FLOW, INDUSTRY & WELDING, OCCUPATIONAL HAZARDS, COMMERCIAL REFRIGERATION AND AIR CONDITIONING. Member, Controlled Circulation Audit, Inc. Not responsible for unsolicited editorial material. Indexed regularly by Engineering Index, Inc.

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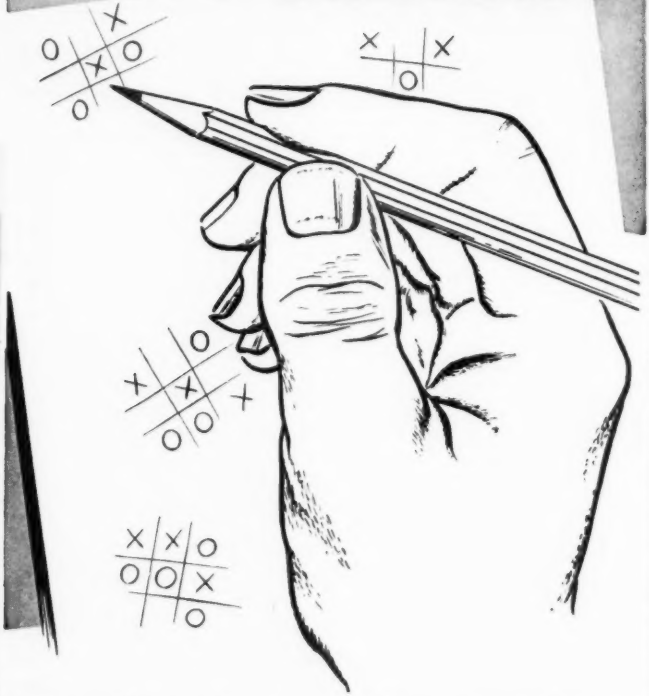
Acceptance under Section 34.64 P. L. & R. authorized at St. Joseph, Mich.

Are You Puzzled?



Yes, die castings are different. It takes more than machines to produce die castings.

Die Castings are Newton-New Haven's business. Here is an organization that has production and engineering talent to help you with your die casting problems.

Newton-New Haven has prepared a booklet on "Dimensioning Die Castings." This is basic data that every Engineer and Designer should have. Write on your company letterhead for your copy.

NEWTON NEW HAVEN

THE NEWTON-NEW HAVEN COMPANY

689 THIRD AVENUE • WEST HAVEN 16 • CONNECTICUT

For additional information circle No. 41 on the Readers Service Card

LETTERS TO THE EDITOR

STANDARD BRAKE PISTONS

We have been asked to quote on an assembly requiring parts in aluminum permanent mold or die castings. As these parts are standard we are attempting to contact a source who has been making these particular castings and could furnish our requirements without die or mould cost.

The parts referred to are brake piston castings for Automotive Hydraulic Master Brake Cylinders. Some models require in addition to the piston casting a filler cap or nut also of permanent mould or die casting.

Anything you can do to put us in touch with such a manufacturer will be greatly appreciated. — R. K.

Information forwarded. — Ed.

OUTSTANDING ARTICLE

I would be very glad if you would send me a copy of the November issue of "Precision Metal Molding". I am specially interested in the article which deals with powder metallurgy, I understand it is one of the best which has been published within the last few years.

If any future issues of the magazine contain similar articles I would be very glad to receive them. — A.F.T.

We appreciate the remarks, but since we featured five major articles on powder metallurgy in November, we do not know whether reference is made to the report, "Powder Metallurgy — Past, Present and Future," or to the article on controlled porosity for chemical de-icers, or one of three case history reports.

We also want to point out that every issue of PMM will have similar coverage — Ed.

EXPENDABLE? ARE PLASTER MOLDS

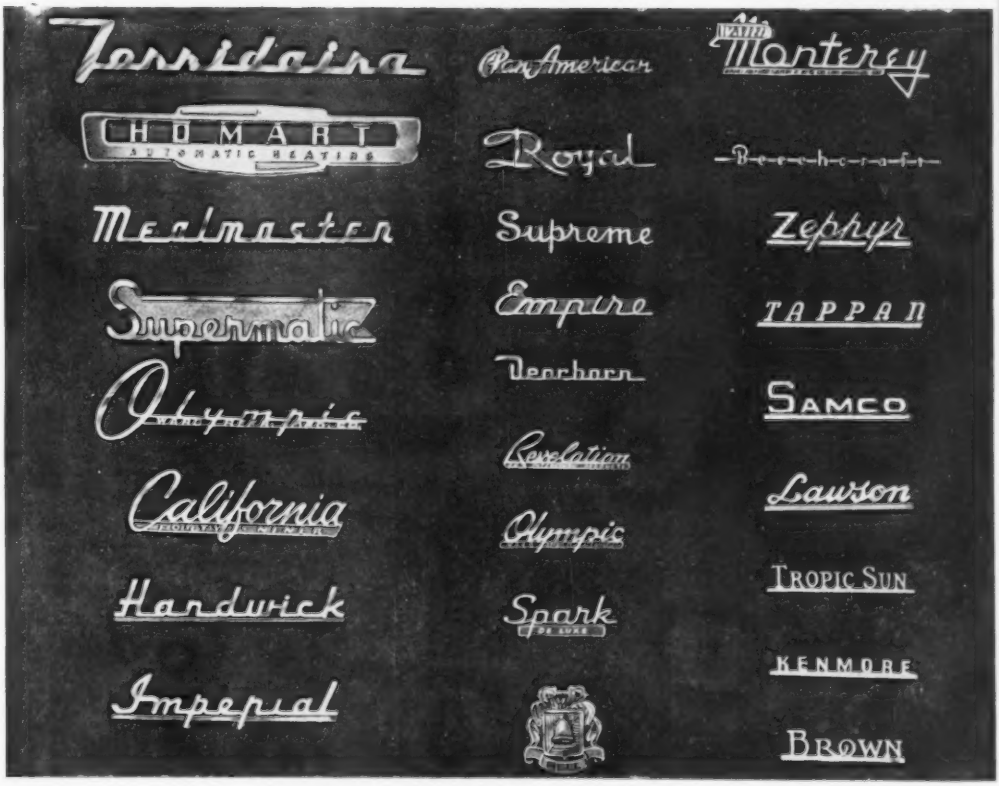
I have been reading articles in Precision Metal Molding magazine on plaster mold castings, and since I am

continued on page 10

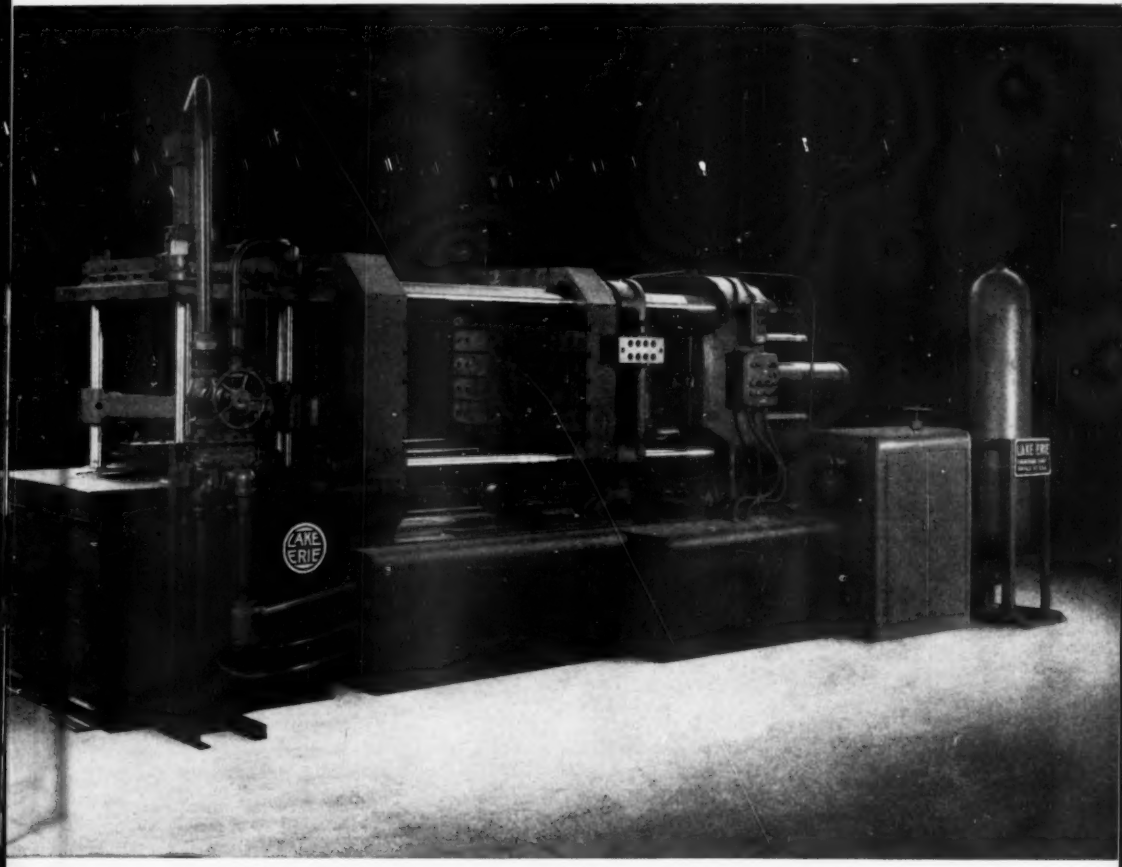
THESE HANDSOME NAME PLATES BY "UDICO" LEND AN AIR OF QUALITY TO ANY PRODUCT.

UNION DIE CASTING CO., Ltd.

2313 EAST 51st St. INQUIRIES INVITED LOS ANGELES 58, CAL.

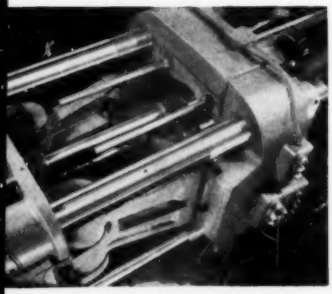


Revolutionary New Answer



Model H-80. Hydraulically operated. 800 ton locking pressure. Push button controlled.

Lake Erie Die Casting Machines set new standards in hourly production and finished casting costs



The "Wedge Cam Toggle" is an exclusive Lake Erie Engineering design.

"WEDGE CAM TOGGLE" The revolutionary Lake Erie "Wedge Cam Toggle" has provided a new standard of comparison for increased die casting production. This self-compensating toggle clamp automatically takes up clearances in the dies due to contraction and expansion of the molds during production or shut-down periods, and, at the same time, engages and disengages easily without binding. This is accomplished by the use of a circular cam contact surface together with rolls which guide the toggles during engagement and disengagement. The toggle action is actuated by a hydraulic cylinder which provides smooth, rapid opening and closing.

"PRESSURE-PAC" This patented unit consists of automatic pressure booster in the hydraulic circuit between the accumulator and the injection cylinder. It provides the necessary pressure to feed the shrink or compress the porosity at the time of solidification of the metal. The standard unit is arranged for 2-to-1 pressure increase. Special units are available for higher pressure ratios.

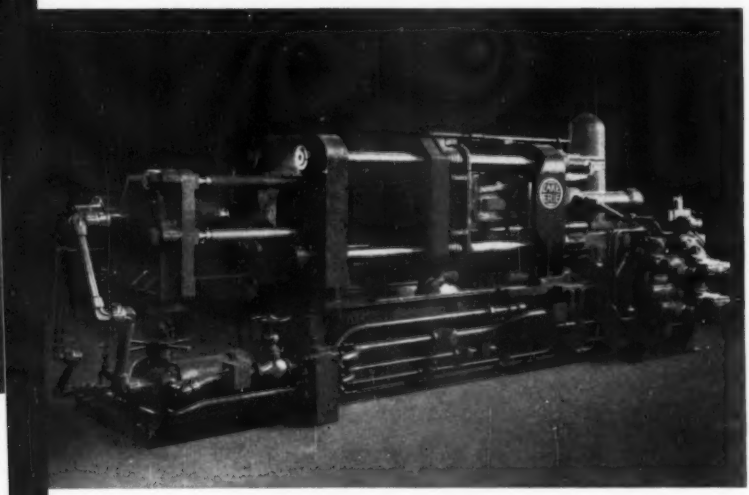
To Die Casting Problems

by LAKE ERIE ENGINEERING CORP. BUFFALO, N.Y. U.S.A.

...these new die casting machines have increased production 15% to 25%

Lake Erie's patented "Wedge Cam Toggle" and "Pressure-Pac" injection unit provide the industry with the first major improvements in die casting machines in many years. In addition to these two *exclusive* contributions to improved production, Lake Erie Die Casting Machines incorporate a number of other engineering advancements—all of which combine to give you die casting equipment which through its increased earning power makes other machines obsolete.

These industry-proven Lake Erie Die Casting Machines are available in 10 models, ranging from 100 to 1000 ton capacity and for casting all the usual non-ferrous metals and alloys.



With all shrouding removed the clean, sturdy construction of Lake Erie Die Casting Machines is self-evident. All parts easily accessible.

OPERATING FEATURES

- **Patented "Wedge Cam Toggle"**

  Self-compensating adjustment for heat expansion.

  Increased hourly production due to positive clamping pressure during each machine cycle.

- **Patented "Pressure-Pac"**

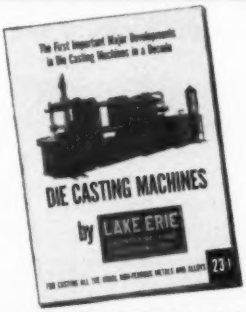
  Feeds the shrink or compresses porosity during solidification of aluminum, magnesium and brass.

  Irons out the skin surface gas lines. Provides denser castings.

Simplified maintenance of all elements including manifold valve block. Faster job set-up. "Jack Screw" pedestal mounting of the injection cylinder facilitates faster change-over from high or low positions of the injection sleeve. Pushbutton control. Automatic continuous cycle or a single cycle operation available. Hydraulic core pulls may be operated on four sides of the platen. Electrical interlock with core-pulls prevents die join.

Write for this Catalog

Illustrations, specifications, application data—all are here in complete detail with full explanation of the patented "Wedge Cam Toggle" and "Pressure-Pac" production advantages.



"Another Lake Erie contribution toward improving industrial production procedures"

LAKE ERIE ENGINEERING CORP.

MANUFACTURERS OF
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LAKE ERIE HYDRAULIC PRESSES are available in any size... standard, modified and special design—horizontal and vertical types—for Metal Working—Plastics Molding—Forging—Metal Extrusion—Processing—Vulcanizing—Laminating—Stereotype Molding—Die Casting—Briquetting—Baling—Special Purpose.

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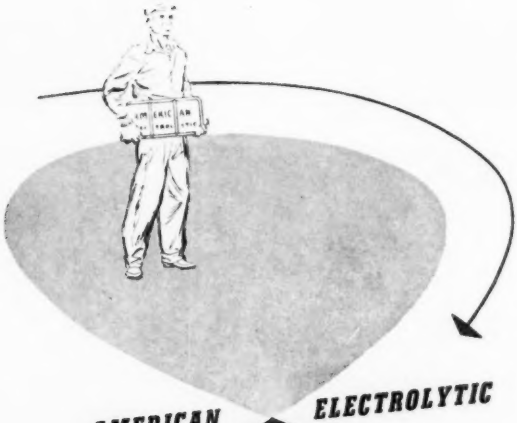

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PRODUCTION

AMERICAN ELECTROLYTIC

99.99+%

ZINC

A reliable source
for die casting requirements

AMERICAN ZINC SALES COMPANY

Distributors for

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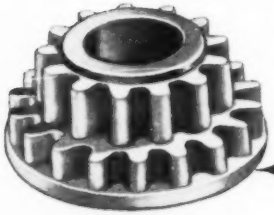
DO's and DON'Ts in DESIGNING ZINC and ALUMINUM DIE CASTINGS

examples by DOLLIN



CLUSTER A

CLUSTER B

PRINCIPLE: **To hold closest dimensions between elements of a part, keep them in the same die component.**

EXAMPLE: It was possible to obtain greater concentricity between the pitch diameters of the two gears in Cluster A than could be obtained between those in Cluster B.

REASON: The two gears of Cluster A could be cast in the same half of the die. In cluster B, the upper gear had to be cast in one half of the die, and the lower gear in the other half. Thus greater tolerances were required between the gears.

WHEN YOU DEAL WITH DOLLIN you can be sure that every one of your exacting requirements will be fulfilled. You can also be sure that Dollin engineers will suggest any changes that will mean a better product produced more efficiently.

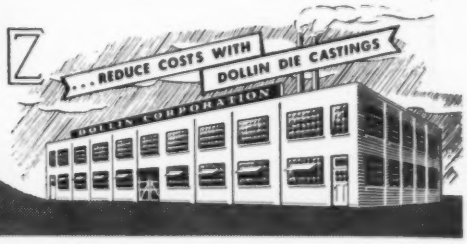
Our broad facilities — which include large plunger zinc machines, large and medium-size cold chamber high pressure machines, and a separate small castings department — permit low cost production of die castings through all commercial sizes. Send prints or samples for quotation — engineering advice provided at no obligation.

The gear clusters shown above were made in Dollin's

SPECIAL SMALL CASTINGS DEPARTMENT
—SMALL ZINC DIE CASTINGS TO 3 OZ.—

For low die and casting costs: small single or double cavity dies plus high speed automatic machines.

PRIME CONTRACTORS — CHECK WITH DOLLIN FOR SUB-CONTRACTING ON DEFENSE ORDERS



DOLLIN CORPORATION
614 So. 21st St.
Irvington 11, New Jersey

SALES OFFICES: Detroit • Philadelphia • Chicago • Boston
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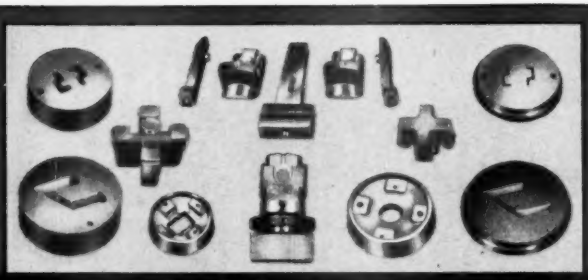

DIES like THESE
are Produced by
Men with Experience
and Quality Machines
at

PMD

PERMANENT MOLDS AND CORES • TUBULAR DIES
EXTRUSION DIES • DIE CASTING DIES

Staffed by specialists with many years of experience PMD is ready and equipped to meet your exacting specifications for highest quality and most intricate dies.

Serving Industry Throughout the United States and Canada, PMD Customers Include: Major Manufacturers in the Aluminum, Appliance and Automotive Industries.

PERMANENT MOLD DIE COMPANY, INC.

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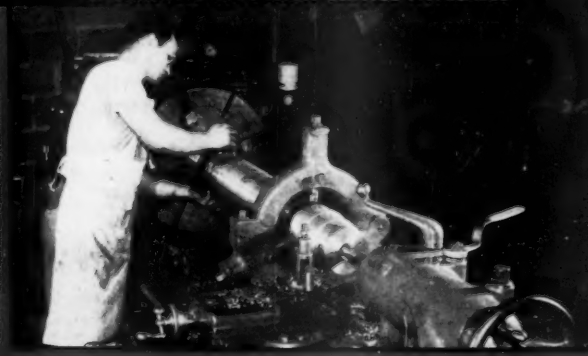
A COMPLETE DIE DESIGN SERVICE AVAILABLE



For additional information circle No. 44 on the Reader Service Card

entirely unfamiliar with this type of casting. I have a question which I would like answered.

From what I can take from the articles, these plaster molds are destroyed after one casting has been poured in them. Is this correct, or can the mold be used for more than one time? — R.P.

The plaster molds used for casting non-ferrous metals are destroyed in the process, similar to sand molds used for sand casting. The process requires a set of master patterns, usually machined from brass, from which cope and drag are made before each cycle. The special advantages of smooth surface and close dimensions, plus intricate coring possibilities, are features of plaster mold casting.

There are several processes by which this casting technique has been mechanized to the point where it is suitable for quantity production; a special molding plaster has been developed to give appropriate chilling action; and a number of companies are producing parts by this method commercially. — Ed.

Have you taken advantage of our Reader Service Section, pgs. 57-62?

EQUIPMENT REVIEW

Please send us a copy of the article, "A Comparison of Commercial Die Casting Machines", by Mr. William During, Vice President of Precision Castings Corporation. This article appeared in the October and November 1950 issues of Die Castings magazine.

We are currently reviewing our equipment and this information would be very helpful.—G.R.T.

Tear sheets sent.—Ed.

Announcing...

FIRST POWDER METALLURGY INDUSTRY DIRECTORY ISSUE

The April issue of PRECISION METAL MOLDING magazine will include — A DIRECTORY OF THE POWDER METALLURGY INDUSTRY. This issue will coincide with the Eighth Annual Meeting and Show of the Metal Powder Association on April 29-30 at the Drake Hotel in Chicago.

For the first time a complete directory will be available on the powder metallurgy industry.

Subjects covered:

(1) A complete fabricators' listing
(2) Raw material suppliers' listing
(3) Equipment and accessory builders' listing

This directory issue is an answer to the hundreds of requests that we have had in recent months for a buyer's guide or central reference for those companies interested in the comparatively new field of powder metallurgy.

The April powder metallurgy industry directory issue will be a valuable part of your working files—be sure to watch for it.

The Editors

PRECISION METAL MOLDING

1240 Ontario Street • Cleveland 13, Ohio

THREE GREAT "MAG" FURNACES

FOR FOUNDRIES, DIE CASTING and PERMANENT MOLD PLANTS

1. Furnace with hood open.

2. Furnace with hood open for dipping.

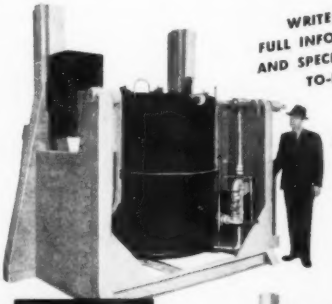
3. Furnace with opening and trough for hot charging.

NEW!

STROMAN TYPE SFE MAGNESIUM MELTING AND HOLDING FURNACES

These furnaces were designed to meet the demands of the industry for faster, more efficient and most economical magnesium melting. Their engineering incorporates many exclusive features. They come complete with sulfur dome and hood. Provisions for hot charging through hood and dome are included. They are excellent furnaces for permanent mold, die casting and sand casting operations. The hoods provide ample venting for the gases of combustion, sulfur and fluxing fumes. They come complete with blowers and choice of oil or gas fire. Automatic controls are also available if desired. Capacities: 250- 350- 600- 800- 1200- 1600-pounds.

WRITE FOR FULL INFORMATION AND SPECIFICATIONS TO-DAY!

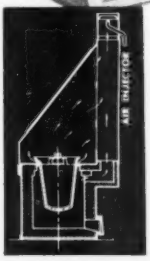


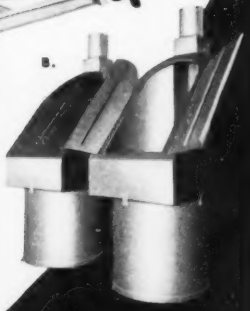
A.

STROMAN MAGNESIUM AND ALUMINUM MELTING AND HOLDING FURNACES

A. Hydraulic Tilt Magnesium and Aluminum melting furnace handling from 500 to 3000 lbs. of aluminum. Incorporates the famous Stroman Stationary Lip Pour, which creates a constant pouring arc at any desired pouring speed. Saves time and metal. These furnaces may be so arranged in series so that several may be operated from one hydraulic pump unit.

B. Stationary Super-Heating or Melting Furnaces, Type S. F. Designed to deliver the correct super-heat to magnesium after it has been melted in larger furnaces, and before it is poured into the molds. Can also be used for breakdown or holding. They have all safety features. Are available for cast steel pots or fabricated steel pots. Furnaces may be equipped with hoods if so desired, for the venting of combustion and other gasses. Write for bulletin No. 100.





B.

LET STROMAN SOLVE YOUR NON-FERROUS METAL MELTING PROBLEMS • WRITE TO-DAY!

STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

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Montgomery Ward's modern washing machine with gyroscopic drive —a gearless mechanism designed for trouble-free service. Built for Montgomery Ward by Apex Electrical Mfg. Co., Cleveland, Ohio!

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Die Casting eliminates those gloomy high cost factors that often threaten to "soak" you plenty once your projects begin to take shape on the drawing board.

For instance, it was the ***reduced cost of production,*** without sacrifice of quality, that determined the makers of Montgomery Ward's "Supreme" Automatic Washing Machine to specify die casting.

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The main bearing carrier (B) was originally a steel tube and flange, arc welded. Redesigned for die casting, this part is produced at a saving of approximately $2.50.

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The portion of the lid hinge (D) was originally cast brass. As an aluminum die casting, about 25¢ have been pared from its production cost.

While it may be noted that prior to the adoption of die casting this washing machine was not in high volume production—and, consequently, initial unit costs probably did not represent the minimums attainable—yet it is certain that only die casting could effect the large savings realized.

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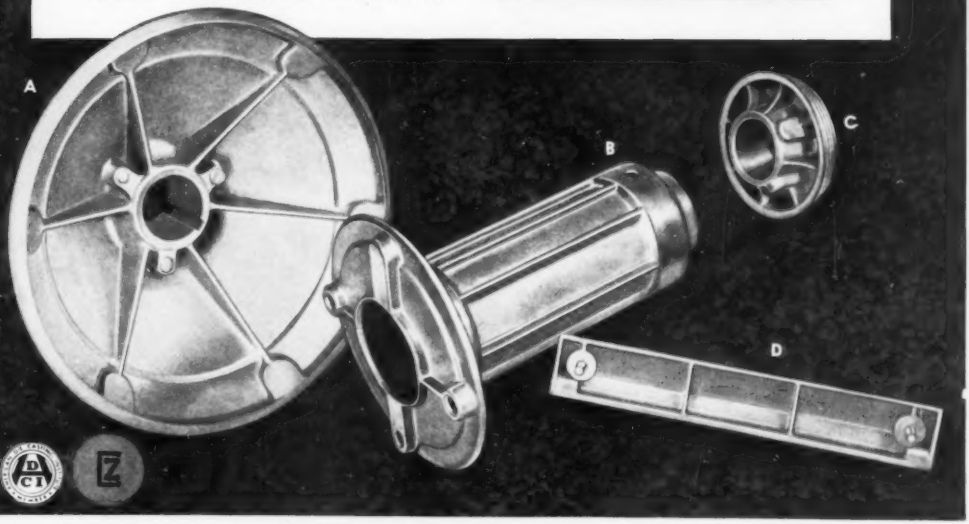

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Within .001 of 1%

PARKER was one of the first to use modern Spectograph analysis to determine percentages of elements present both in incoming raw material and in finished Die Castings. This operation is examining a photographic negative and is able to determine through line densities the amount of each alloy and impurities within .001 of 1%. This is one of the reasons why Parker is able to meet any material specifications.

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hydraulic fluid temperatures
GUARDED THE SAFE WAY
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In wide use throughout the copper, brass and aluminum industries of the United States and Canada are numerous Lombard hydraulic extrusion presses like the 4-column, 1100-ton model shown.

Because the manufacturer, Lombard Corporation of Youngstown, Ohio, stresses careful engineering of all design details, it is only natural that a Ross Exchanger is assigned the responsibility of guarding fluid temperatures in the pumping unit. Performance-proved Ross Exchangers fit in with Lombard's theme of economic operation and long life.

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For full details, request Bulletin 1.1K5.

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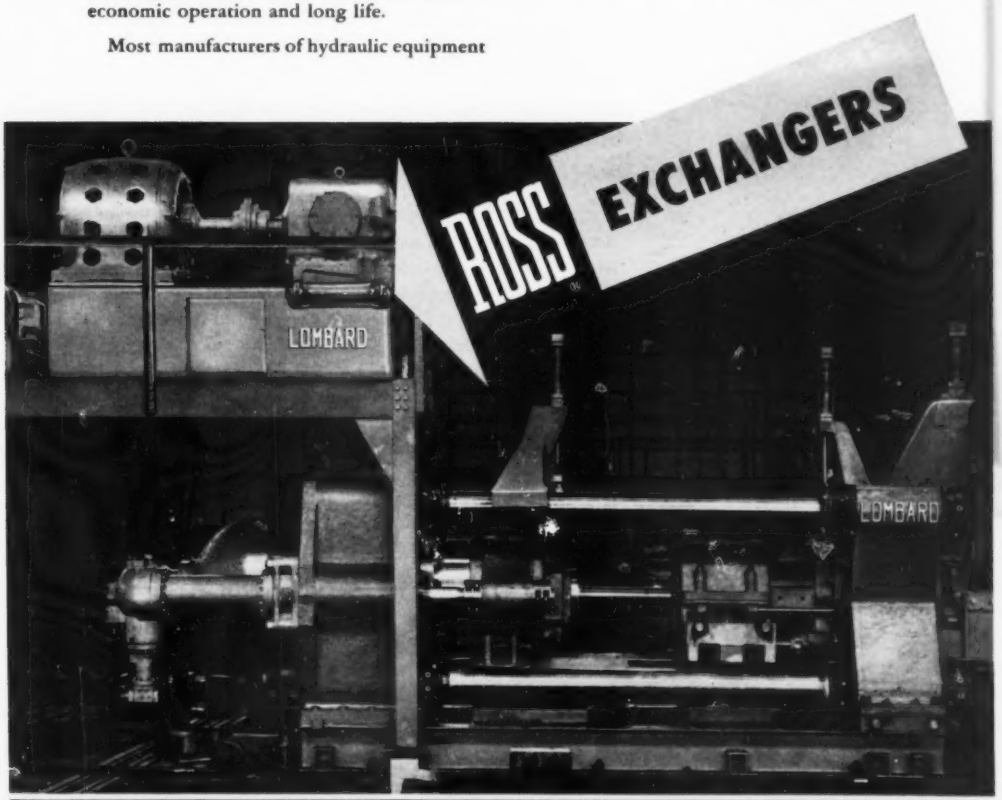

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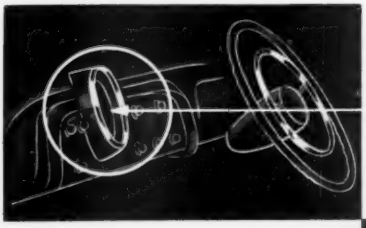
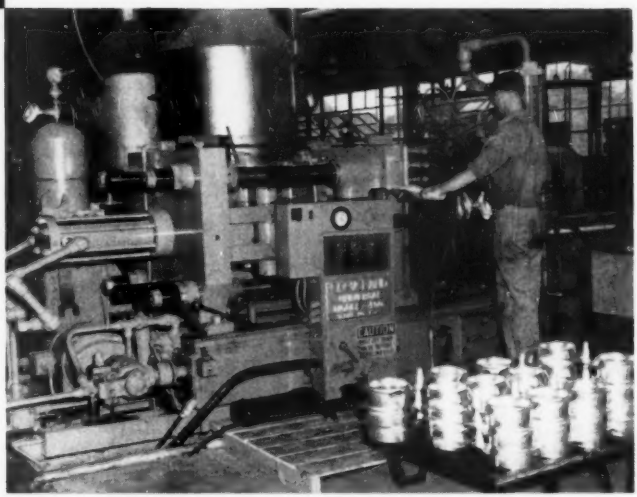


426 MPH*

in a CLEVELAND die casting machine!



* That's the actual figure, but the abbreviation stands for units *made* per hour — in the Cleveland Die Casting Machine shown at right. Working in the ultra-efficient King-Seeley plant at Scio, Michigan, this Cleveland machine is speeding production of automobile dashboard instrument parts. The part being produced, an instrument cluster housing, is shown below, "as cast."

King-Seeley uses zinc die castings extensively for such parts as the horn ring shown below; housings for telegages (water temperature, fuel level and oil pressure); bezels; small intricate frames; and speedometer and gauge components. Chances are your car has several King-Seeley products in it.

King-Seeley Corporation, leading supplier of dashboard instruments to major automobile manufacturers, is widely known for excellence of product design and construction; for high efficiency in manufacturing methods. To maintain critical standards in its die casting department, King-Seeley relies on a Model 400 Cleveland to produce top quality castings at high speeds.

Typical of the parts produced on this Cleveland machine is the instrument cluster housing shown above. Approximately six pounds of zinc alloy are injected into the die, producing two parts per shot. The Cleveland's powerful die locking pressure and high injection speed produce sound, dense, *"hardware finish"* castings. Dimensions are held to close tolerances. Secondary drilling operations on the part have been eliminated by precision coring of 13 holes. Production averages 213 shots—426 parts —made per hour.

To get the *most* from *your* die casting department—in speed of production and quality of casting—profit from the experience of leading die casters and investigate the advantages of the Model 400 Cleveland. Your inquiries will receive prompt attention. For machine specifications, write for free copy of bulletin.

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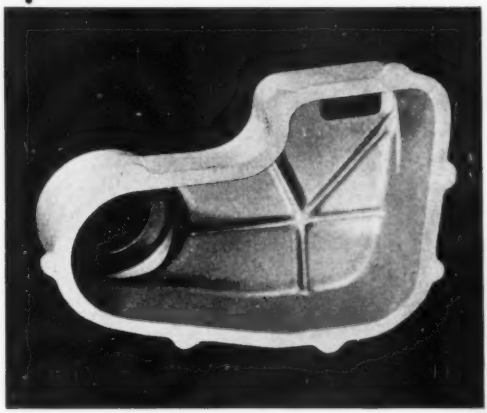
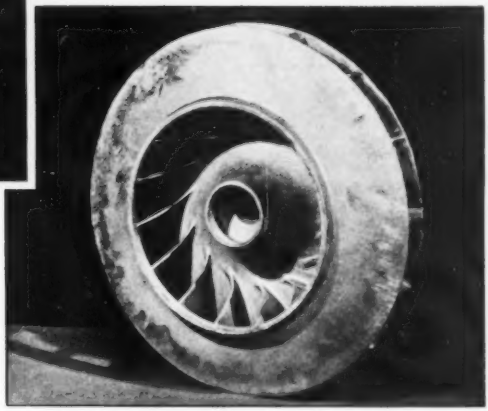
FOR PEACE



OR DEFENSE



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During World War II Acme produced a wide variety of castings for aircraft and aircraft accessories and for numerous complicated ordnance parts. Production on some of these parts has never been discontinued.

This experience and our engineering knowledge is available to you. Acme engineers will work with you on problems of design, cost of producing samples, production costs and cost of patterns or permanent molds to produce high quality castings.

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Worth looking into, don't you think? Hoover is set up to work with your product designers and engineers every step of the way, or to take complete charge from drawing to delivery.

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Formerly sand cast from solid brass, this product required a baked sand core for each valve and six separate finishing operations. When die cast by Hoover from an aluminum alloy, production costs dropped 50%. May we show you other examples of Hoover Die Casting? Write for free booklet, or for a Hoover engineer to call.

THE HOOVER COMPANY, Die Castings Division, North Canton, Ohio

HOOVER

Specialists in the field of die castings since 1922

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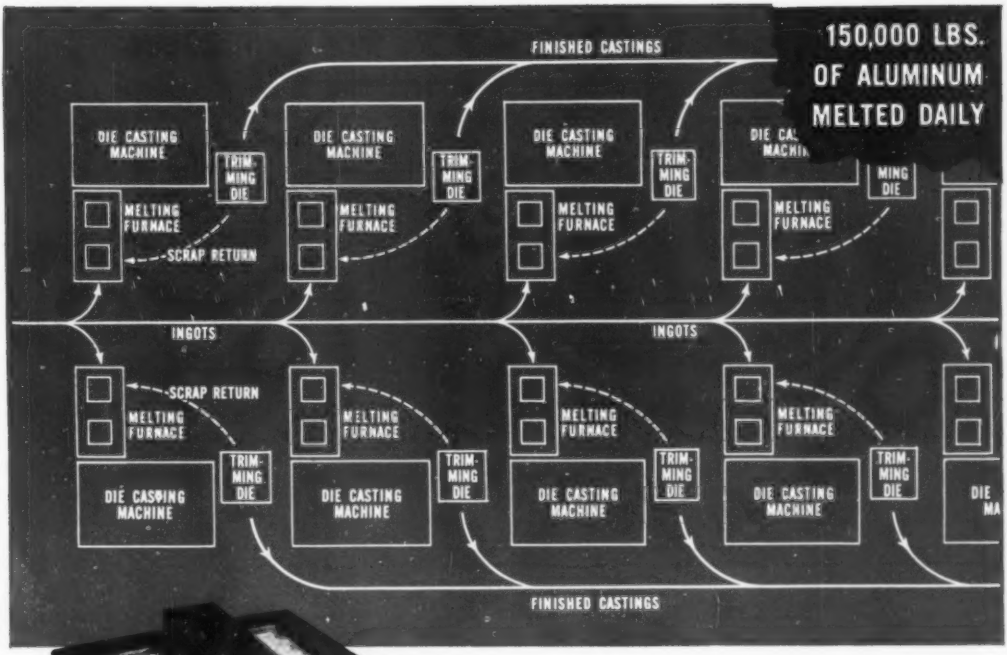

One of the nation's newest die-casting plants uses 15 Lindberg Two-Chamber Furnaces in their die casting operations. These furnaces, operating on a 24 hour a day schedule have the capacity to melt 150,000 lbs. of alloy per day. Each furnace serves a separate die casting machine to produce these production advantages . . .

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No scrap sorting—scrap metal and reject castings never leave the machine, allowing the use of a different alloy in each machine if necessary, while completely eliminating scrap sorting, handling and identification problems.

Unified production unit—each die casting machine becomes a unified production unit—receiving cold alloy ingot, melting, holding, casting, inspecting, reclaiming scrap metal and reject castings—delivering only the finished casting to the production line. Obviously the savings realized are spectacular.

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"balance, 99.99+% zinc" *

DESIGNATION & COMPOSITION OF ZINC DIE CASTING ALLOYS:

	REFERENCE DESIGNATION	ALLOY 2	ALLOY 3	ALLOY 5
	NOMINAL COMPOSITION	Copper 2.5-3.5% Alum. 3.5-4.5% Mag. .02-.10%	Alum. 3.5-4.3% Mag. .03-.08%	Copper .75-1.25% Alum. 3.5-4.3% Mag. .03-.08%
ASTM	*American Soc. for Testing Materials*	*B86–XXI*	*B86–XXIII*	*B86–XXV*
SAE	*Society of Automotive Engineers*	*921*	*903*	*925*
NAVY	*U.S. Navy*		*46Z2b– Class A*	*46Z2b&c– Class B*
ARMY	*U.S. Army*		*57-93-2A Alloy A*	*57-93-2A Alloy B*
FED	*Federal Specifications*		*QQZ–363A*	*QQZ–363B*

The phenomenal growth of the die casting industry—the second largest consumer of zinc today—was chiefly provided by the development of "four-nines" metal—which is standard for all zinc alloy die castings.

Prior to 1928, the year Bunker Hill pioneered the production of "four-nines" metal, zinc die castings based on lower grade metal were restricted in their applications due to limitations in physical properties. But as soon as industry was enabled to write "balance 99.99+% zinc" into their specifications, the quality and stability required in die castings were available and the use of zinc alloy castings increased enormously. Die Casting—the shortest distance between raw material and finished product—proved the answer to industry's need for accurate, high-speed and low-cost production of the most complex parts, in a single operation, just as zinc has proved itself as the ideal base metal for die castings. Currently over 70% of all die castings by weight are made of zinc.

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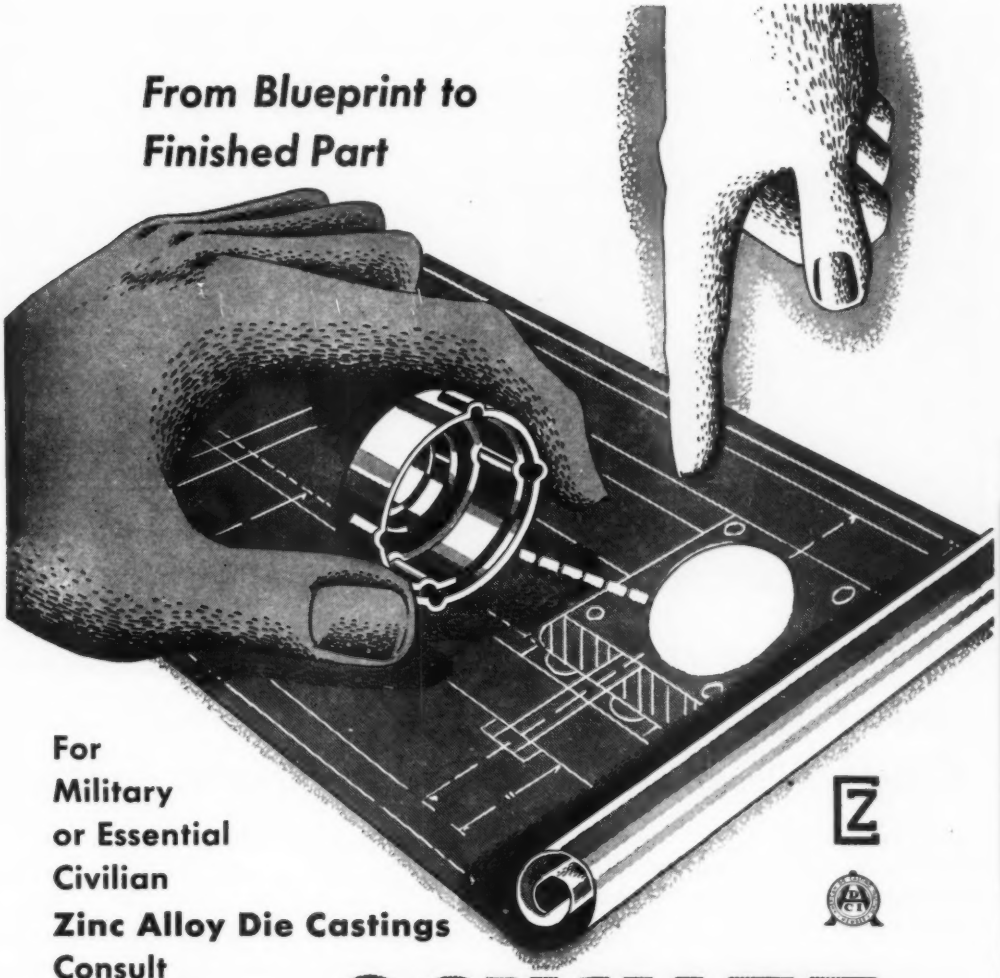

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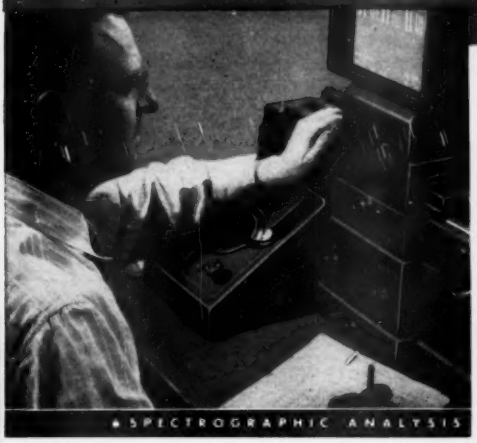

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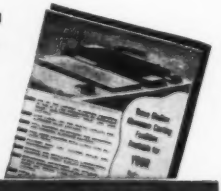
Write for your copy of new Bulletin No. 20A illustrating and describing our facilities for supplying the castings you want, when you need them.

Send blueprints for recommendations and estimates on your aluminum castings requirements.



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ALUMINUM PERMANENT MOLD, SAND and DIE CASTINGS...HARDENED, GROUND and FORGED STEEL PARTS

For additional information circle No. 6 on the Reader Service Card

THE PROSPECTS FOR ZINC

- will there be enough for military and non-military uses?
- how much will be available for die castings?
- what are the long range prospects?

IN January, for the first time in more than a year, an apparent easing of available supply of the special high grade zinc necessary for producing zinc alloy die castings developed as a result of several factors:

- Curtailment of automotive production which accounts for a major portion of zinc die castings consumed;
- Retrieve of considerable tonnage of special high grade that had been allocated for stepped-up brass production;
- Virtual halt of stockpiling of zinc.

There were signs that steady improvement in availability of zinc would continue throughout 1952. With die casters getting up to 55 percent of allocations plus enough zinc for A through E orders in January, an official of the National Production Authority commented that "if the die casting industry needs more metal, it can be made available quite early in the year."

Prospects for some sort of balance between world and domestic zinc concentrates to ease the position of American smelters in the latter part of 1952 were predicted by the American Zinc Institute.

The big question . . .

Meanwhile, after a long dearth of zinc for lower or non-rated orders, buyers of castings, product designers and die casters, alike, were asking these questions: "What are the prospects for the future? Will there be enough zinc to cover need during the present emergency? What about long range prospects?"

To obtain answers to these questions, the editors of PMM talked with industry leaders, government officials, spokesmen for trade associations and commercial die casters. Their opinions and predictions are summarized here.

Tonnage of special high grade zinc

One of the most obvious pieces of information which needs to be fitted into the jigsaw puzzle of supply and demand is the amount of slab zinc produced by U. S. smelters.

It should be made clear at the outset that only metal classified as "special high grade zinc" can be used for making on-grade zinc die castings. This metal, having 99.99 percent purity, is required to meet industry standards.

A detailed report released by Ernest V. Gent, executive vice president of the American Zinc Institute, Inc., tabulates U. S. smelter slab zinc production showing the percentage of special high grade. The upward swing of slab zinc production is indicated in Table 1, which also shows that the output of "special high grade" is somewhat improving its relative position.

In 1952, U. S. smelters will have the capacity to produce from 950,000 to 1,000,000 tons of slab zinc. On the basis of the lower estimate, production of special high grade would approximate 305,000 tons or 32 percent.

"These estimates for 1952," the report states, "are of necessity predicated upon the assumption that the demand will be sustained and that the necessary concentrates will be available. Fortunately, there has been a significant increase in domestic mine production, commencing in the last quarter of 1951, and there is reason to believe that imports should flow more freely in this direction in 1952."

To reach the 1,000,000 ton figure, slab zinc output in 1952 will depend upon imports. U. S. smelters and pigment plants have estimated their 1952 requirements of concentrates at approximately 1,100,000 tons of recoverable zinc. Domestic mine production in 1951 will total about 675,000 tons, with some increase indicated for 1952. The remainder must be imported.

"So long as prices abroad continue to divert zinc concentrates to other countries," according to the Zinc Institute report, "it will be dificult to solve the problem of securing sufficient feed material for United States smelters and pigment plants. There are indications that world concentrate requirements may approach a balance in 1952—which, if true, should result in an easing of the position of the United States smelters in the latter part of 1952 or in 1953."

A final piece of pertinent information relating to the long range availability of zinc is contained in a tabulation of estimated world zinc reserves, Table 2. The report draws attention to the substantial increase in measured reserves despite the accelerated rate of depletion since 1931. Basis for the figures included in the estimate is a report presented at a meeting of the Institute of Metals in London, October 19, 1951 and published in January of this year.

Abnormal use of special high grade in brass

Any examination of reasons for acute shortages during 1951 would have to include a note concerning the use of special high grade for brass.

Starting early in the year, brass production was upped from 11,000 to 16,000 tons per month. In order to meet this increase in tonnage, it was necessary to divert some of the available special high grade zinc in addition to the prime western and high grade which are normally used. The result was a decrease in the amount of special high grade available for die casting and galvanizing.

By the end of 1951, NPA had worked out a more equitable distribution of zinc, and the extra drain on special high grade was eliminated, returning considerable tonnage to its normal channels.

Curtailment of stockpiling gives relief

An important percentage of monthly production of slab zinc has been removed from availability by the government program of stockpiling. This program was scheduled for completion by mid-1951, and currently, it is reported, the only slab zinc going into stockpile is a very small tonnage per month from government-owned concentrates.

During past months, NPA has been able to supplement some allocations of zinc for hard-hit die casters, especially in the Great Lakes area, by allocating Canadian zinc. Two handicaps have made this impractical on a larger scale: a disadvantageous freight rate to other zones and a .7 cent duty. By the end of 1951, considerable difficulty was encountered selling Canadian zinc because of this differential, and present government thinking opposes any supplemental allocations.

An amended bill before the Senate now is aimed at suspending import duties on zinc ores, and zinc in blocks, pigs and slabs. An earlier bill covering a wider group of zinc products was passed by the House but defeated in the Senate.

As this issue was going to press, an announcement was issued by the Canadian government that more zinc would be available for United States consumers during 1952. Included is an increase of 4,000 tons of zinc die casting alloys. Since, as one source expressed it, these alloys now appear to be available "in plentiful supply", the announcement is of considerably less interest to die casters in this country than it would have been as recently as three months ago.

Cutback in consumer hardgoods

All of the previous factors representing an increase in the amount of zinc available for die casting have been

TABLE I

U. S. SMELTER SLAB ZINC PRODUCTION*

	Total (Tons of 2000 lbs)	Special High Grade (Tons of 2000 lbs)	Percentage
1947	862,037	239,274	27.8
1948	850,084	248,346	29.2
1949	869,823	230,576	26.5
1950	914,437	271,678	29.7
1951 (Est.)	930,000	279,000	30.0

*U. S. Bureau of Mines figures are quoted for the years 1947-1950. American Zinc Institute preliminary figures are shown for 1951.

Will there be enough zinc to go around? We asked some of the leading smelters and here's what they told us . . .

H. L. YOUNG, *American Zinc Sales Co.*

The outlook for special high grade slab zinc for the die casting industry and other consumers appears to be somewhat more favorable in 1952 and in the more distant future than it has been during the past 18 months. Planned increases in production seem to indicate sufficient special high grade to satisfy both domestic and present military requirements for the metal. The long term outlook for increased supply of concentrates and additional smelting capacity continues to improve, and barring abnormal military demand and interruptions in production beyond the control of the producers, there should be adequate supplies of special high grade slab zinc in 1952 and in the future to satisfy demands of the civilian die casting industry.

American Zinc has recently completed installation of production improvements which are expected to produce approximately 20% more special high grade slab zinc in 1952 than was produced by American Zinc in 1951.

CHARLES R. INCE, *St. Joseph Lead Co.*

All in all, there is every prospect that for the foreseeable future, zinc supplies will be adequate for every need. This should be reassuring to zinc customers who during the past year have had difficulty covering their requirements due to a shortage of supplies, largely caused by Government controls imposed upon our economy as a result of a war effort which so far has taken no more than 10 percent of the zinc supply for direct military orders.

E. H. KLEIN, *Metal Div., New Jersey Zinc Sales Co.*

To many of us concerned with zinc and other basic metals, the last two years have been confusing, and at times, frustrating. The demands created by a growing military program and government stockpiling, at a time of unprecedented production of consumer goods, created a condition which was difficult to analyze in terms of past experience.

However, now that the military needs for zinc have been reasonably well established, it is possible to get a clearer picture of the availability of this metal in the months ahead. It is becoming increasingly apparent that the pattern of supply and demand can be expected to follow that prevailing during World War II.

In the early stages of World War II, just as in the first stages of the present national emergency, zinc was placed on the list of most critical materials. As early as 1943, zinc was moved to what was then known as the No. 2 or less critical list, which meant that the supplies were sufficient to meet the military demands plus essential industrial needs. At that time, the War Production Board made the following statement regarding the die casting industry, which is the largest consumer of special high grade zinc:

"We believe that it is quite appropriate, at the present time, to advocate the increased use of the die casting process. Die casting, with its characteristic rapid production and low scrap losses, combined with the elimination of costly machining and assembly operations, can be a tremendous factor in the conservation of materials, man and machine hours. Although the metals suitable for use in die castings are still relatively critical, the savings in labor to be effected by the use of this process is becoming increasingly important and is playing a larger part in any decision as to the process to be utilized in the production of a given product."

The foregoing statement is as timely today as it was during World War II and product designers would do well to use it as their yardstick in considering the use of zinc die castings. The heavy demands for zinc have created the impression that this metal will be in short supply for a long time to come, and many designers have, therefore, been seeking substitute materials. The physical and economic advantages of zinc die castings are such that in many cases other materials and manufacturing methods cannot be reasonably substituted. Furthermore, it is likely that any materials which might be considered as substitutes will be in increasingly short supply.

Under these conditions, and particularly in view of the American Zinc Institute's prediction that the supply and demand for zinc will be brought into balance by other means than restricting use, it would appear that designers should continue to take advantage of zinc die castings.

important from a long range viewpoint: increases in slab zinc production, relief from brass requirements, the completion of stockpiling, the likelihood of improved world zinc distribution.

However, perhaps the greatest single contributing factor in the increasing availability of zinc has been the cutback in consumer hardgoods. Due to the shortage of other metals, the automotive industry, in particular, has been hard hit.

This has temporarily affected one of the die casting industry's best customers. An important tonnage of zinc die castings is consumed annually for decorative and internal components of cars: handles, carburetors, fuel pumps, grilles, trim, horn rings, instrument panels, luggage compartment hardware and many other elements.

At least for the duration of the present emergency, this metal and the die casting capacity for shaping it, will be available for substitute uses. It will, in many instances release vital machine tools and skilled manpower now occupied in secondary operations on parts machined from bar stock or rough castings.

During World War II, zinc die castings were used in large volume for Ordnance components, Quartermaster supplies, Air Corps and Naval equipment. At the present time, however, procurement of die castings for military uses is very limited because of the small, pilot

continued on page 86

TABLE 2

ESTIMATED ZINC RESERVES
(in metric tons)

	Production of Zinc in Ore	Estimated Reserves
1931	1,200,000	27,000,000
1940	2,000,000	43,000,000
1947	1,750,000	63,000,000
1948	1,800,000	70,000,000

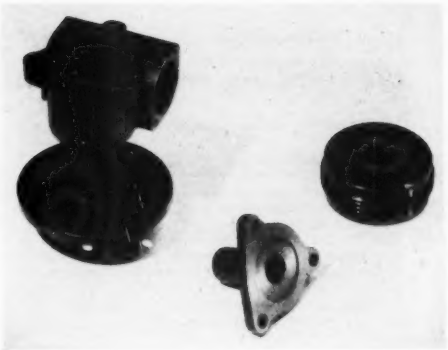
Romec Pump Div. of Lear, Inc.

depends upon

PMM parts produced by

die casting, powder metallurgy &

permanent mold casting



1. BLACK ANODIZING of these die cast aluminum jet engine components meets government specifications and provides protection against corrosion.

SAVING OF MACHINE TIME is the most where

THE peculiar nature of demand in the aircraft industry has an important effect upon the suppliers of components and their choice of fabricating methods.

Initial orders are generally for limited quantities with follow-up orders largely unpredictable, being determined by factors beyond the scope or control of the supplier. It is therefore common practice to amortize engineering charges, along with tooling and setup expenditures, over the first production run.

This might, at first glance, be assumed prejudicial to the use of die cast components, however desirable they might otherwise seem from the shop man's point of view. The initial investment in dies might appear to be a deterrent to the economical production of limited quantities of parts.

That this is not always the case is well illustrated by the many applications of aluminum alloy die castings in aircraft pumps and accessories manufactured by the Romec Division of Lear, Inc.

Probably the largest single factor favoring the use of dozens of die cast parts by this company is not the lower piece price but rather the relief of machine time, factory space and skilled labor on a production line normally requiring an undue amount of skilled machine work.

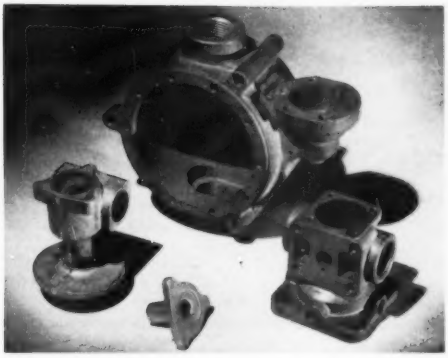
Although many individual considerations are weighed in designing each part, a general review of die cast parts now purchased by the Romec Division indicates that quantities of 5,000 are frequently most economical and practical as die castings; the turret lathe and similar machine tools get the major share of production when quantities drop to 500 pieces.

Die castings used in these pumps are produced by the S.U.S. Die Casting Co. of Logansport, Ind., and the Doehler-Jarvis Corp.

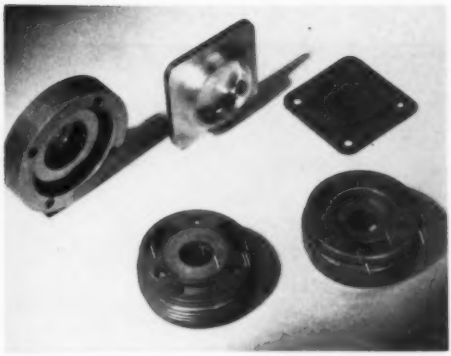
Porosity and corrosion problems have been solved.

Neither porosity nor corrosion of the aluminum die castings is regarded as a problem. Romec has been able to obtain die castings which are substantially free of porosity, especially in critical areas. Occasionally this requires minor concessions on wall thickness, fillets or other details in order to help the die caster achieve sound castings.

In some of their pumps, particularly those concerned with water injection, electrolytic corrosion is a problem



2. ABILITY TO CORE INTERIOR details is one important advantage which the die casting process has for pump housings. A high order of density is obtainable.



3. SMALL FITTINGS such as these are generally die cast because it is a good way to relieve overcrowded machine tools and to save production time.

important factor

DIE CASTINGS are used in aircraft pumps

which has been solved by a system of coating, gaskets, sleeves and bushings. The electro-chemical reaction between the aluminum housing and the carbon and stainless steel components in the presence of water is prevented by coating the inside of the castings with an inert, synthetic material, and insulating the pump body from the engine or driving motor with special gasketing, a Bakelite ring, and sleeves and washers over the mounting studs.

Aluminum parts are anodized according to government specifications, and certain die cast components are black anodized. One of the black anodized aluminum die castings illustrated here is the housing for an air intake screen actuator for jet engines designed by Lear, Inc. of Grand Rapids, Mich. and now produced by the Romec Division.

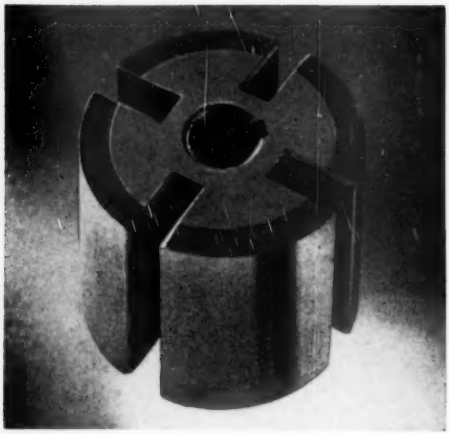
Complex shapes are received close to finish dimensions.

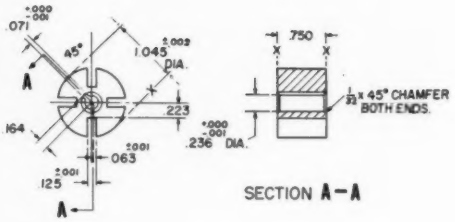
In one category of component, die castings have an enormous design advantage — complex housings. The ability to core internal cavities so close to finish dimensions that a single boring operation to remove draft, plus one or two light milling cuts for parallelism on flanges and mounting surfaces saves many valuable man-hours of machining.

In Figure 2 are three typical housings which are die cast to save on machine time. The largest of these shown is also one of the highest production items to be die cast, having been a standard unit for many years in the Romec line.

The limiting feature in pump housings appears to be the ability to pull cores. Where holes cannot be formed by a straight core pull, sand castings or permanent mold castings are utilized.

For the same reasons—the elimination of in-plant machining operations—castings are used for small fittings which look like typical screw machine parts cut from bar. A group of these, shown in Figure 3, are either die cast complete, or as in the case of the fuel pump lock nut which has a thread around its circumference, die cast as a blank to be finish machined. This particular die casting also saves critical aluminum through the introduction of three metal saving cores as reliefs in the thick wall section. (Continued)





4. FOUR RADIAL SLOTS gave plenty of trouble when this rotor was machined from bar stock, but after being converted to an iron powder piece, rejects are rare. Dimensions are closely held, and the slots need no machining.

High rate of rejects cut with iron powder rotor

One of the most difficult parts to produce by machining is the rotor which holds four vanes in the dry air compressor. This compressor which operates at 1/15 hp to supply oil-free compressed air to radar and other electronic installations, includes the first use which Romec Division has made of powdered metal structural parts, although carbon-graphite components have long been standard parts.

The rotor, supplied by the United States Graphite Company of Saginaw, Michigan, represents a saving of about 60 percent over previous machined rotors, most of the saving coming from elimination of the majority of machining operations.

Reference to the above drawing will reveal the closeness of tolerances. Most difficult part of the entire unit is to hold the four slots to size and location. This was the greatest source of rejects when the rotor was machined from bar stock. Now, rejects are almost eliminated.

The rotors are pressed to close limits, top and bottom being held within .003 total indicator reading for parallelism, flatness, smoothness and squareness. Slots are pressed within ± .001 and require no further processing.

Three cuts are required after the rotors are received: the OD is machined within + .0000— .0010; relief is cut on the ends, and the bore is cut to tolerances of + .0002 — .0000. Obviously, these tolerances are closer than can be obtained in powder metallurgy and must be machined.

After machining, the rotors are given a corrosion protective surface by electrolizing. This electrolytic process is unique in that it does not build up radius, throws into recesses, and can be held to extremely close tolerances. Thus, the specifications call for an electrolized coating .0001 in depth, not to affect any of the critical tolerances shown on the drawing. This job is done by the Electrolized Tap Corp. of Cleveland.

Relatively few sand castings appear in Romec pumps.

Permanent mold castings are easier than sand castings to locate and chuck

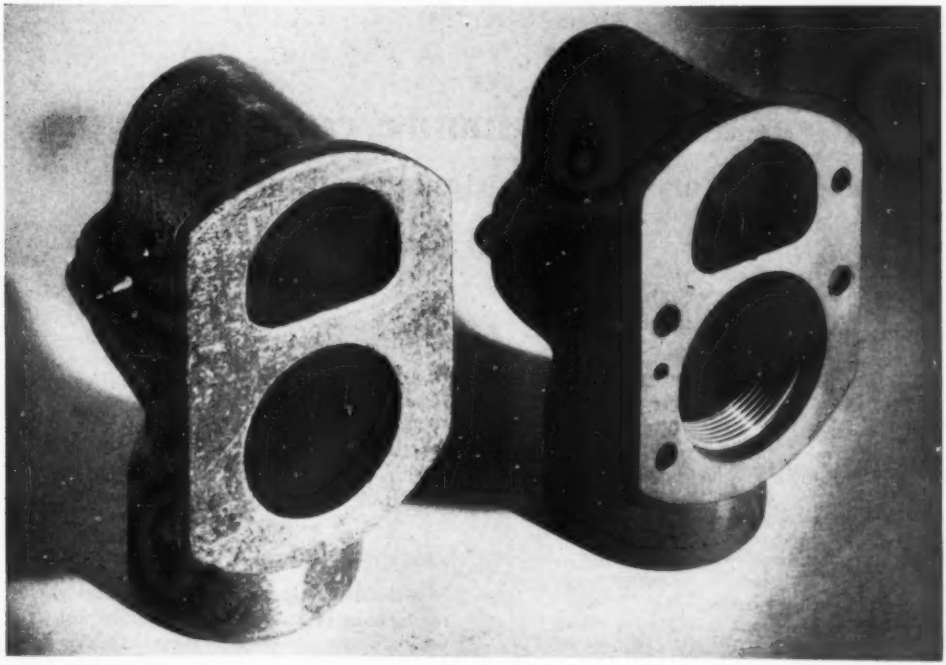
Permanent mold aluminum castings lend themselves to production machining so much more readily that this is the preferred form of casting.

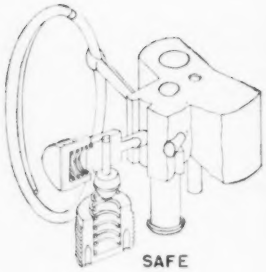
While little attempt is made to achieve finish dimensions as cast, the over-all accuracy of the permanent mold casting makes the design of jigs and fixtures and the chucking of castings much easier.

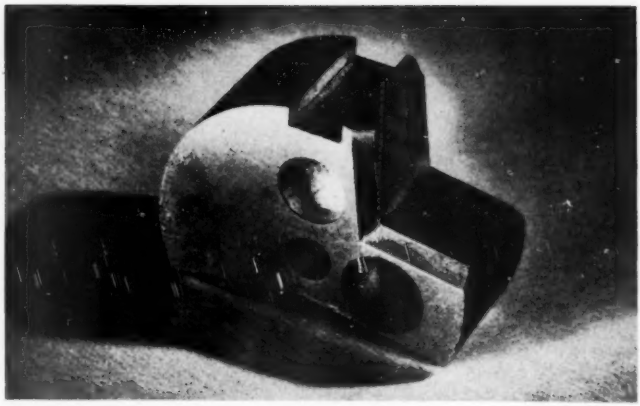
One important characteristic of the permanent mold casting is its sound internal structure. Even in the lower pressure ranges, soundness is a desirable property in order to avoid seepage or leakage of critical fuel or hydraulic systems.

A typical permanent mold casting used by Romec is shown in Figure 5, as cast and machined. This casting is part of the RD 8500 fully submerged water injection pump which supplies water and alcohol mixtures that are vaporized in the engine combustion chamber. Interior of these castings are given corrosion protection through the insulation of dissimilar metals, as previously described. Suppliers of permanent mold castings used by Romec Div. are Monarch Aluminum Mfg. Co. of Cleveland and the Permold Co. of Medina, Ohio.

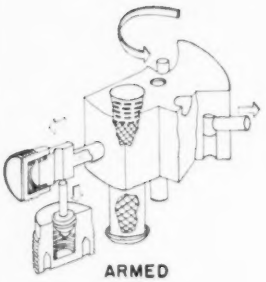
5. DENSE METAL STRUCTURE is a desirable characteristic of permanent mold aluminum castings such as this housing, shown before and after machining. Note, the interior of the casting at the right has been coated with an inert, synthetic material which prevents electrochemical corrosion.







1. AT LEAST SEVEN METAL POWDER FABRICATORS are now producing these rotors at an average hourly rate of 1,000 per hour per set of tools. Not so long ago, many people said that it was an impossible and impractical job, but having solved production control problems that beset them, the powder metallurgy industry is now proceeding to turn out completely satisfactory ordnance pieces from brass.



2. THE TWO POSITIONS of the rotor are illustrated by (a) **above** and (b) **below.** A complete description of the action of this critical assembly, both for safety and effective operation, are described in pages 35 and 36.

Powder Metallurgy produces a brass ordnance component:

the full case history of an important piece

By CAPT. JOHN DALE
Frankford Arsenal

THE small brass rotor, Figure 1, for the M21A4 booster is the first Ordnance component made of brass to reach large scale production by powder metallurgy.

In the middle of World War II, the supply situation on copper moved from critical to impossible and the Ordnance Corps wisely explored the possibilities of making this booster rotor by powder metallurgy. By the time the product engineering was complete, hostilities had ceased and there was no further pressing need for a substitution, even though it did involve elimination of a 35% scrap loss.

While the powder metallurgy technique often produces a product with characteristics impossible to achieve by any other method of manufacture, the M21A4 booster rotor is a straightforward mechanical component and powder metallurgy is in essence, a new metal-working method which makes possible very high rates of production with precision.

Among the seven metal powder fabricators now holding contracts, it is reported that these rotors are being produced at an average rate of approximately 1,000 per hour per set of tools.

Lower scrap loss brings lower costs

In the beginning it was seen that if the physical requirements of this vital part could be met, there were intriguing advantages in using the powder metal-

lurgy process. In addition to the precision and high rate of production, there was an estimated cost saving of approximately 40 per cent over the old method of producing rotors from extruded 70-30 brass bar stock. Actually, some contracts have been let at a cost saving near 70 per cent.

One of the reasons for the lower cost was the virtual elimination of scrap loss; another is that the component made from powders could be made in a lower density, comprising approximately 13 per cent less metal, and without sacrificing a real margin of safety in physical performance.

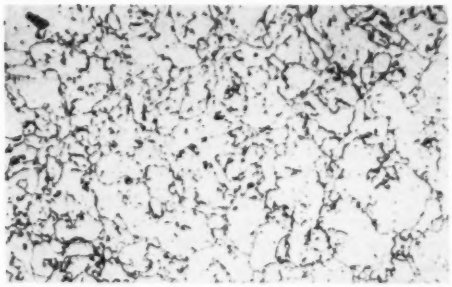
Secondary advantages of vital importance during mobilization are the utilization of production capacity not otherwise burdened, and relief of the pressure on brass fabrication mills to produce the exact size of bar stock required. Brass in powder form is a single raw material from which all sizes of stock are made. Inventories are vastly simplified.

Ordnance engineers involved in the materials engineering study and the problems of redesign were not free to authorize a substitution without considering the grim reality that upon the performance of the fuze and booster depended not only the proper function of a round of artillery ammunition, but the very lives and safety of our American soldiers and their fine equipment. As development work began, it was made very clear to all that no redesign or compromise would be accepted which could have even the slightest tendency toward compromise of performance and safety. But as the dramatic story unfolded, and as each of the numerous problems was solved, it was established that the rotors produced by powder metallurgy were superior in many ways to those produced by the old method.

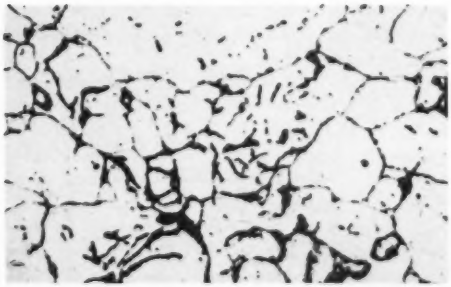
Before it was determined that a density of 7.4 gms/cm^3 was required, there was a serious question as to whether proper function could be guaranteed with less metal to do the work with the consequent reduction in tensile strength. The rotor is a vital part of the assembly, occupying a large part of the space within the booster body, and as such it had to be verified that a reduction in weight would not significantly alter the performance of the booster and the fuze.

Safety considerations outlined

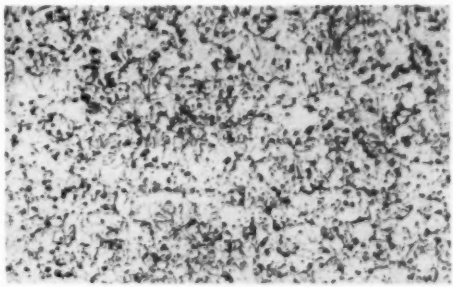
Ordinarily the booster is assembled to the fuze during loading, and the assembly is handled thereafter as a single unit. Until the shell is fired, the rotor is locked in the unarmed position by a centrifugal pin. Figure 2a illustrates this unarmed position, and shows the rotor with its center of gravity off the center line of the pivot center. As the shell begins to rotate, the rotor turns



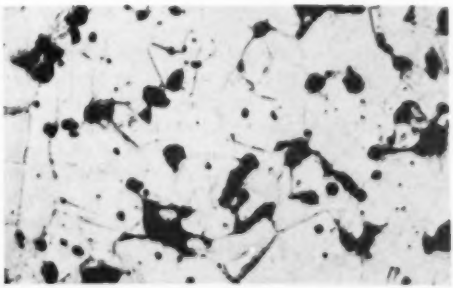
3a. Insufficiently sintered 80-20 leaded brass. 250 magnifications.



3b. Insufficiently sintered 80-20 leaded brass. 1000 magnifications.



4a. Properly sintered 80-20 leaded brass. 250 magnifications.



4b. Properly sintered 80-20 leaded brass. 1000 magnifications.

5. PRESSING A BRASS ROTOR. This powder metal press operation is shown in the ejection stage. From here, the brass pieces go into a highly critical sintering operation. In a future issue of PMM, the production of carbide dies for pieces such as this having irregular contours, will be the subject of a feature article.

under centrifugal force to a precisely aligned armed position.

Figure 2b illustrates how it strikes a stop pin where it is locked by further pin action for the duration of flight of the projectile. The fuze initiates the explosion at the proper time, and the rotor in the armed position brings the lead azide-tetryl detonator into line. Explosion of the detonator through the booster lead sets off the booster charge which in turn detonates the high explosive charge of the projectile.

The place of powder metallurgy in current defense production will be discussed at the 8th annual Metal Powder Association meeting in April. For a full list of papers to be presented, please turn to page 68.

Any premature detonation of the explosive charge in the projectile could cost the lives of our own troops. To insure this feature of safety, a rotor which functions properly has to be able to withstand explosion of the detonator with the rotor in the unarmed position without transmitting the explosion to the projectile itself. Detonation ordinarily shatters the rotor in an area immediately around the detonating charge, but so long as the explosion is not transmitted, the booster is safe. The sintered brass rotors performed satisfactorily in these tests and established themselves as a proper safety mechanism, equal in performance from that standpoint to the rotors produced from the bar stock of somewhat higher physical values.

In preliminary firing tests and spin tests conducted at the Picatinny Arsenal, it was determined that the critical density requirement which controls centrifugal motion of the rotor had been achieved and uniformly maintained. Picatinny Arsenal also was satisfied that the 80-20 leaded brass rotors could withstand the high impact developed by the action of the stop pin.

There was a justifiable reluctance on the part of Ordnance Engineers to consider substitution of the 80-20 leaded brass for the 70-30 brass. Adjustments had already been made with respect to the density of the part and to certain of the physical properties. There was a distinct feeling that a limit had been reached on permissible variations from the old specification. In line with its assigned mission of basic research in nonferrous metallurgy, and because of the availability of specialized personnel in powder metallurgy at the Frankford Arsenal, a prompt and thorough evaluation was made with personnel of the two arsenals collaborating. Further important tests were conducted, and some of the mystery surrounding the powder metallurgy technique was removed, revealing both its advantages and its limitations. From that point, Ordnance and industry began to speak and understand the same language. The one was aware of the methods of approach and problems of the other. The fields of possible compromise were delineated and final production samples were submitted for approval. Once the obstacles were cleared, the project moved into production.

Production problems reviewed

In retrospect, it is evident that the principal earlier problems were mental hazards and mental reservations, lack of understanding of what powder metallurgy could or could not do, and the lack of realization, by the powder metallurgy trade, as to how little compromise there could be in the performance of a component which so directly affects the lives of our soldiers, and performance of artillery. It is interesting to review some of these obstacles and some of the problems which were created in the early days of production by several of the fabricators who first began to produce these rotors by powder metallurgy.

The original 70-30 brass alloy specification with the inherent high physical values based upon theoretical density of 8.53 gms/cm^3 would be uneconomical if produced by metallurgy. Under ordinary manufacturing methods, such as those used for the civilian economy, 7.7 gms/cm^3 was the average density found to be practical. Higher values could only be obtained by subsequent working. *The suppliers of parts made from brass powder also know that in working with 70-30*

continued on page 69

Positive engagement in Toothed Clutch Plates with *Investment Casting*

THE determining factor, in most cases, for a change from an existing method of manufacture of any part to an investment casting is reduction of cost. Instances occur where the complexity of the part is such that no other method of manufacture will do the job adequately, but these are less numerous than those involving manufacturing economy.

It can be argued that regardless of the apparent reason for change, economy is the underlying cause. There are, however, parts in an assembly where better functioning or interchangeability of components or both is the only reason for the use of investment castings, regardless of whether there is a reduction in manufacturing cost or not.

This reason for change is well illustrated in the toothed clutch used by the Partlow Corp. in their line of interval timers. These timers are designed to either open or close a circuit after some predetermined interval of time which may vary from a fraction of a minute up to several hours. Between the timer motor and the gear train which ultimately operates a micro-switch is a toothed clutch actuated by a small relay. The two clutch members are investment cast of beryllium copper by the Arwood Precision Casting Corp., of Brooklyn, N. Y.

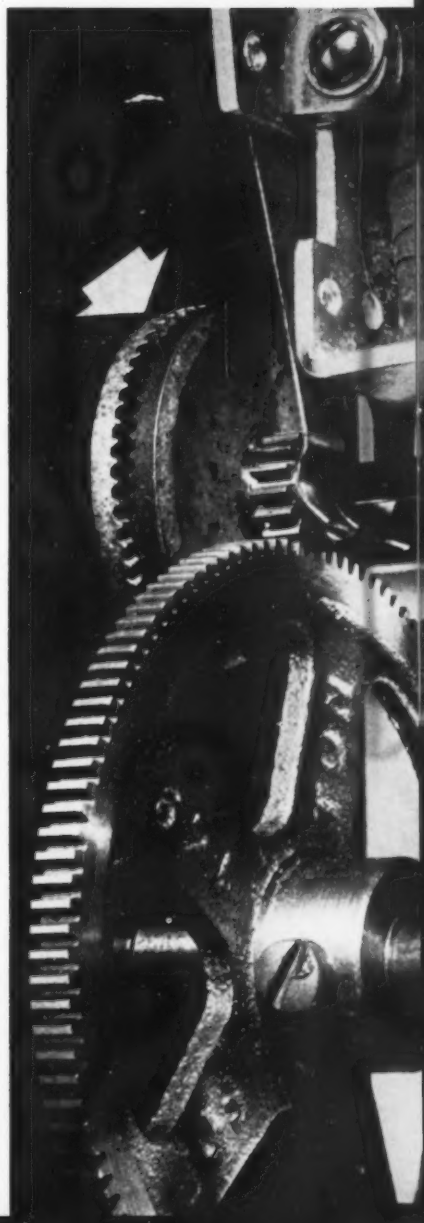
Progression: from screw machine to coining to investment casting

The genesis of the design is interesting, showing as it does a progression from low cost screw machine operation to the higher cost investment casting in order to secure better and more reliable operation.

The first clutch members were machined from bar stock and the mating faces knurled to give a reasonably positive locking. Crude though this method was, it produced a usable clutch. Slippage of such a clutch was unavoidable, however, so that a change was made to machined steel plates on which teeth were coined in a cold forging operation.

This change resulted in a better clutch, but alignment troubles cropped up to plague the designers. So long as both clutch plates were held in almost perfect alignment, good operation was secured. The necessary perfection of alignment was impossible to secure in a moderately priced timer and the clutch was changed

continued on page 85



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CONTINENTAL Motors Corp. has been recognized for many years as one of the top motor building companies in the world. They are and have been constantly experimenting with new type motors and have worked closely with the government in the development of motors in the truck, tank and aircraft field.

One of the large motors they are building* in production quantities necessitates the use of a cast aluminum oil pan measuring approximately 38 inches long x 14 inches wide x 14 inches deep and is designed to weigh 32 pounds. The flange of the pan is designed with 28 bolt holes, inside the pan are two baffles on the side of the sump well with two cored drain holes at the bottom of each baffle, on the side of the pan is an inspection port with eight bolt holes, on the bottom of the pan is a drain hole, opposite the inspection port are located 2 bosses for the purpose of installing an oil heater which is necessary in about 25 per cent of the pans.

Originally these castings were made in sand molds. With the assistance of considerable mechanical equipment a crew of five men and a coremaker were able to produce 20 molds per 8-hour day. Casting weights were ranging from 37 to 42 pounds.

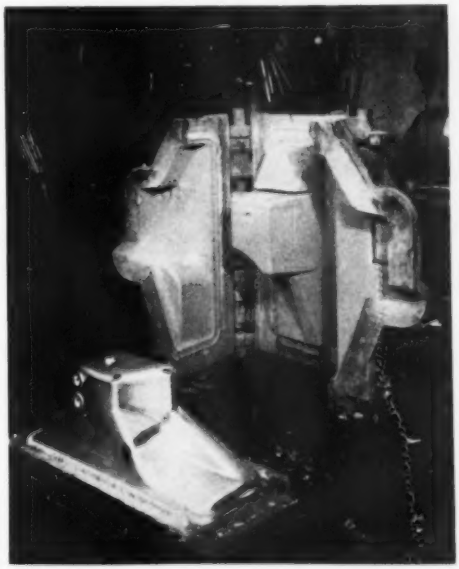
Continental Motors' purchasing and engineering departments, always alert to procure a better part at a saving and concerned by the developing aluminum shortage, called in the Aluminum Permanent Mold Co. of Grand Rapids, Mich. to analyze the possibility of permanent mold for this intricate part. The important factors considered were the extreme differential in piece price to be realized by the anticipated increased production as well as an appreciable saving from the more accurately controlled weight of the casting and the considerable saving in machining cost due to more accurate coring. After thorough discussion of all possibilities, construction of the die was authorized.

The permanent mold die, which together with the mechanism weights between four and five tons, was constructed by the Modern Pattern & Model Works of Grand Rapids. Incorporated in the mold design was the coring to size of all the bolt holes on the mounting flange, the drain holes at the bottom of the baffles, the bolt holes around the inspection port, and the drain hole on the bottom of the pan.

The hydraulically operated hinged type mold is set up near holding furnaces which are supplied metal by a

continued on page 63

WITH THIS HYDRAULICALLY-ACTUATED and clamped book-type mold, two men can produce 80 large oil pan castings per 8-hour day. When these oil pans were sand cast, five men and a coremaker could only manage to turn out 20 per day.



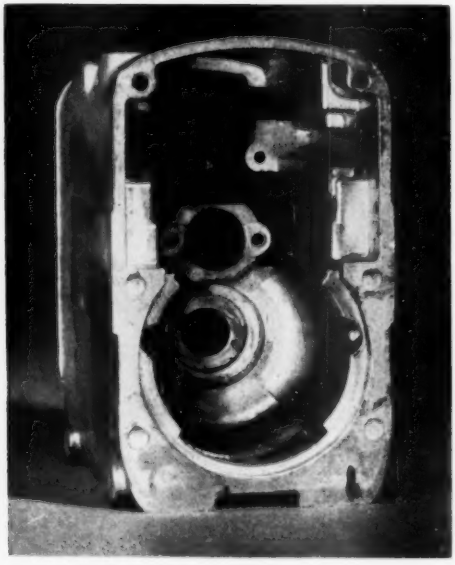
*Sorry, but no design or performance data can be given because this motor is a highly classified piece of equipment.

TO MAINTAIN ALIGNMENT

between interchangeable magneto components, American Bosch uses *Die Casting*

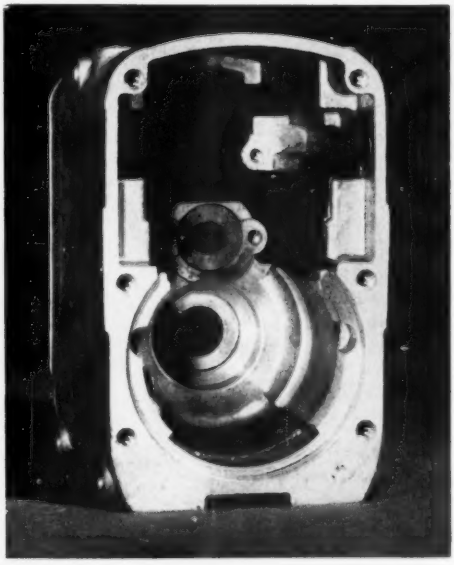
TO secure the operational characteristics that are required from magnetos, it is necessary that dimensional uniformity of a high order be maintained. Assembly procedures and the possibility of occasional field accidents require that the parts be made interchangeable and that any end plate fit any body, for the same style magneto, and still maintain the air gap and alignment that is required.

To do the meticulous job required and still keep manufacturing costs within reason, the American Bosch Corp., of Springfield, Mass., has found that aluminum die castings do an admirable job. The type MJK magneto illustrates this.



FIELD LAMINATIONS ARE CAST AS INSERTS in the die casting and all needed holes whether for mounting, assembly or bearings are either cored or located in the rough casting, Figure 1, **above.**

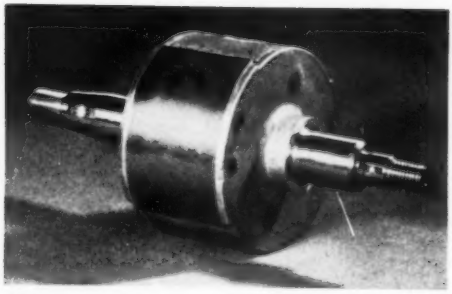
The requisite that all parts be interchangeable requires that assembly holes, mounting holes and matching surfaces be held to closer dimensional tolerances than is possible in normal die casting procedures. American Bosch engineers have, therefore, allowed the caster rather open tolerances and expect to do a considerable amount of machining on the casting after it is received.



THE BORE FOR THE ROTOR BEARING is the basic locating point for machining on the same casting, shown in Figure 2, **above,** after all machining has been completed. The air gap between the rotor and the stator is maintained at 0.004 to 0.0065 and must be uniform. Therefore the bore for the rotor must be concentric with the bearing bore within 0.001 TIR.

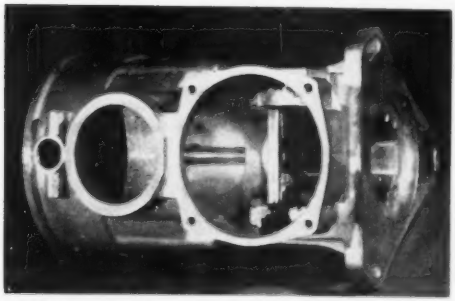
The face against which the end plate carrying the other bearing is mounted must be precisely at right angles to the axis of the rotor and the end plate mounting holes must be located so that there will be no misalignment.

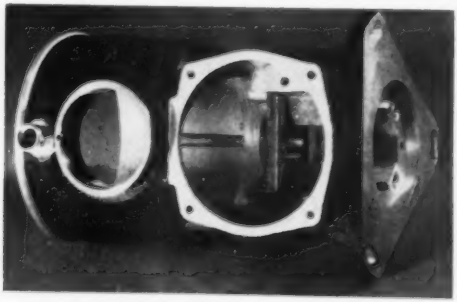
DIFFERENT MOUNTING ARRANGEMENTS must be provided, since the one type of magneto may be used on several different models of tractor. This has necessitated three different end plates. All three designs are shown **above.** As was the case with the bodies, complete interchangeability of end plates is required. Die castings have met all of the requirements for the end plates with regard to strength and machineability.



TWO HUSKY ALNICO MAGNETS are cast as inserts in the rotor shown in Figure 4, **above,** which is an aluminum die casting. The assembly of the rotor requires pressing the shaft into the casting and then machining the OD to the required size. Since the permanent magnets are too hard to be machined and must be ground, the die casting is held smaller than the magnets so that there is practically no machining on the aluminum as a finishing operation other than to ream the bore.

ON THE SOMEWHAT LARGER SIDE is the aviation type magneto shown in Figures 5 and 6, **below.** The over-all height of those castings is some 14 to 16 inches and they are about six inches in diameter. Due to the necessity of packing auxiliary equipment into the same housing these die castings are larger and more complex than the housing for the type MJK magneto. As in the smaller unit, all critical dimensions are given open tolerances with stock allowed for clean up in the final machining operations. Those body castings have the field laminations cast as inserts in the die casting. The two views below give an idea of the piece as cast, **left,** and as completely machined and finished, **right.**





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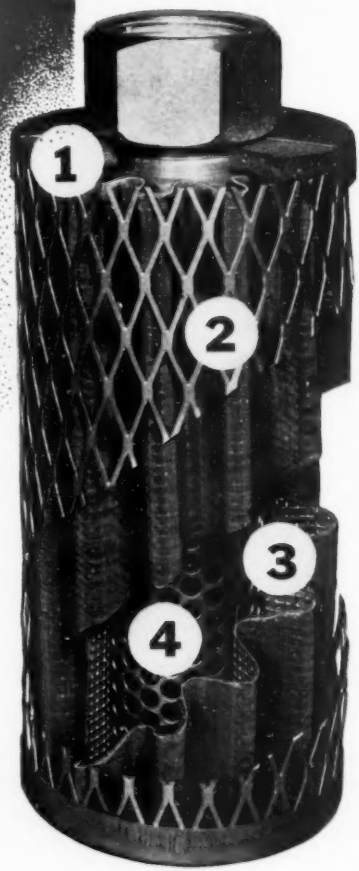

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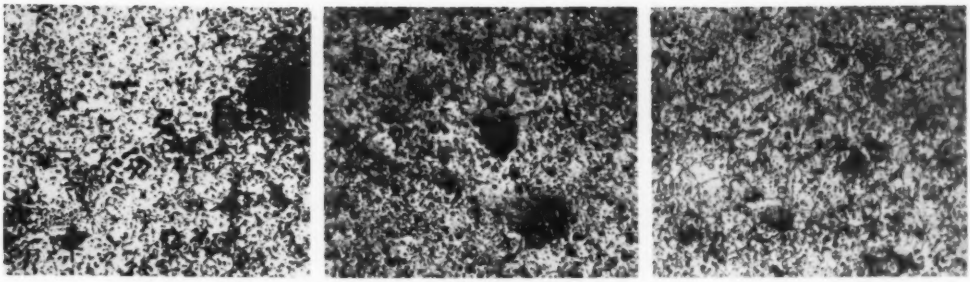


5.4 g/cc 5.8 g/cc 6.2 g/cc

IRON POWDER COMPACTS, pressed and sintered (250X). All three compacts are of the same powder. Note progressive decrease in porosity. (Photomicrographs courtesy of Amplex Div., Chrysler Corp.)

PHYSICAL PROPERTIES OF SINTERED IRON COMPACTS

	Electrolytic Iron	Oxide Reduced Iron	Carbonyl Iron	Atomized Iron	Ingot Iron
Density g/cc	5.81	5.80	5.98	5.79	7.87
Ultimate Tensile strength, psi	14,200	15,300	16,000	16,700	39,200
Yield point, psi	12,400	13,100	15,360	—	—
Elongation, percent in 2 inches	5.04	2.86	3.85	1.10	35.20
Hardness, Rockwell B	20	21	34	20	30

Note: The values given are for quite low density material. As the density increases, the physicals also increase and with full density, the ultimate tensile strength, elongation and reduction in area are materially higher than the average values for ingot iron.

Design data for
Low density iron powder parts

IF iron compacts are to be used, the designer must know some of their properties, a little of how they are made and some of the limitations both of the process and the material. This article will, therefore, attempt to give some specific information that can be used in design work and a general review of the method of making iron compacts.

As in previous articles, emphasis is placed upon consultation between the prospective user of parts and a competent contract producer since there are very few industrial establishments that have their own production facilities and most users depend upon the contract shops.

For the purpose of this article, iron compacts will be divided into two broad classes:

I. Low density iron compacts having a density of less than 85 percent of theoretical.

II. High density iron compacts having a density of 85 percent of theoretical or higher.

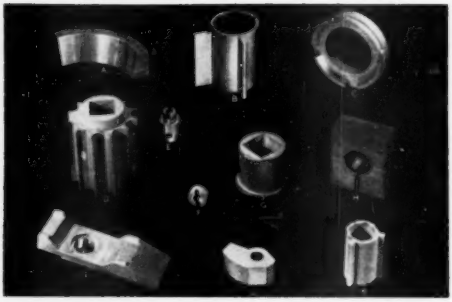
This division is purely arbitrary, but when considering such phases of production as carburizing and finishing, it forms a logical point of demarcation.

Of these two classes of iron compacts, the high density ones are, at the present time, a very small minority but are important from the point of view of future applications of powder metallurgy and the potential growth of the industry.

Low density iron compacts comprise at least 95 percent of the present production of structural parts being made from iron powder today. The development of iron powder metallurgy has followed directly from the work on copper and bronze powders and has opened to the designer and to the fabricator of parts an entirely new field in which to work.

This is the second of five articles on the availability, design and application of iron powder parts. Iron powder is a non-allocated material in ample supply (PMM Jan. 1952).

For the production of low density iron parts, any of the standard powders currently available can be used. Of these, the imported Swedish sponge iron is prob-



TYPICAL OF GOOD SUBSTITUTION PRACTICE, these parts made of iron powder are replacing machined bar stock or machined castings made of allocated materials and are showing a reduction in cost as an added attraction. (Photo courtesy of the Wel-Met Co., Kent, Ohio).

ably the least expensive followed by oxide reduced, atomized and electrolytic iron powders, the latter being the most costly. Each type of powder has its own particular features that make it most desirable for a particular application. This selection, however, can best be made by the parts fabricator.

Except for the electrolytic iron, all of the powders noted carry some extraneous material. Depending upon the application, these may or may not be classed as impurities. The imported sponge iron will normally have a moderate silica (SiO_2), alumina (Al_2O_3) and manganese oxide (MnO_2) content. These oxides are not reducible in the normal sintering atmosphere and will carry through into the final compact in the oxide form. Despite these oxides, the sponge iron will normally assay 95 to 98 percent iron.

Molding pressures seldom run over 50 tons per square inch and sintering is carried out at around 2000 F for from 15 to 60 minutes, depending upon the part being made.

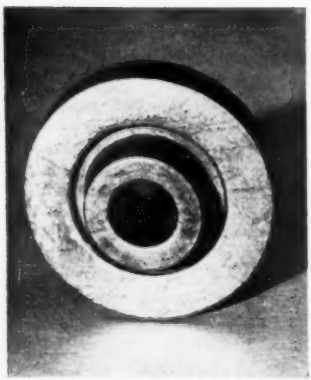
Physically, these low density iron compacts tend to be rather weak as compared with ingot iron, for example. For design purposes, an ultimate tensile strength in the sintered but not carburized condition of 25,000 psi is a safe figure although with further processing, tensiles several times this value can be attained. Elongation is about 10 percent or less. Hardness is variable, depending upon the type of powder used and the values are not dependable. Some typical values of physical properties for very low density compacts as compared with ingot iron are given in Table I.

The major field for these low density compacts is in the bearing and bushing field where their unique self-lubricating ability is of major value. The degree of porosity, and hence the final density of the compacts can be controlled quite accurately by proper selection of the particle size distribution in the iron powder and by the pressure used to form the green compacts. This feature is utilized in bearings and in the special case of metallic filters. In this latter case, a nearly spherical powder is used of carefully graded size so that a uniform porosity can be secured.

As the density is increased, the porosity of the com-

continued on page 77

Manganese bronze gear blanks by Plaster Mold Casting



PLASTER MOLD casting is finding increasing use where a surface finish superior to that secured by sand casting is needed and where the dimensional tolerances of the rough casting are closer than a sand casting can give.

Generally intermediate in cost between a sand casting and a permanent mold casting (where the same alloy is used), plaster mold casting is becoming a valuable production tool.

A typical use of this process is in the casting of worm gear blanks used by the Bodine Electric Co., of Chicago, Ill., in their small gear head motors. The plaster mold castings are a manganese bronze alloy cast by the Universal Casting Co. of Chicago, Ill. and replace sand castings formerly used.

The sand castings, for some reason never determined, tended to develop minute cracks, some almost microscopic, as much as a year after the castings were made. In many cases, these cracks did not develop until after the gear had been cut and the motor put into service.

Thus far, after some years of experience, the plaster mold castings have shown none of the defects of the sand castings and have, in addition, been lower in final cost than a sand casting. The manganese bronze is used for its excellent wear characteristics.

FINISHING SECTION

MACHINING—Most precision metal molded parts require some machining operations. In this section will be found information to aid in planning and selecting the proper methods and equipment for these operations.

ASSEMBLING—Precision metal molded parts are generally components of assemblies. This section includes information on fastenings and methods for mass production assembly operations.

SURFACE FINISHING—Many precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating or chemical coating. This section includes information on the methods, processes and equipment used for these surface treatments.

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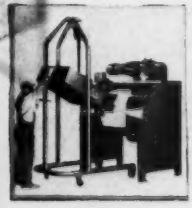

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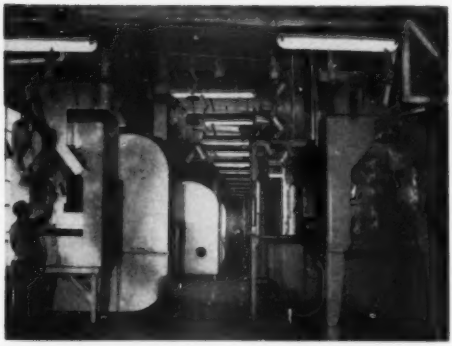
getting uniform coating of paint is the key to a controlled wrinkle pattern; here is a report on a successful painting cycle

FOR NON-GLARE SURFACES: wrinkle paint applied to die castings by electrostatic spray



1. CLEANING, PHOSPHATE COATING AND DRYING are combined into one U-shaped machine with a complete cycle requiring 19 minutes. Castings enter at right where they are subject to spray washing with an emulsion cleaner mixed with mild alkali. At the left, the conveyorized racks of castings emerge dried and ready for painting.

2. ELECTROSTATIC SPRAYING with automatically functioning spray guns is the means by which Burroughs combines the required speed with the uniformity of paint coating needed for high quality surface finishing.

WHILE it's true that there is more to a business machine than meets the eye, there can be no doubt that what does meet the eye is of vital importance.

Surface reflectivity on business machines is a major consideration and to obtain non-glaring surfaces, many months of research have been consumed. Especially during the war, when there was a tendency toward stepped-up lighting, the problem of eye strain became serious in banks and other business houses where employees work for long hours at business machines.

The Burroughs Adding Machine Company of Detroit has met the need for non-glaring surfaces by introducing a wrinkle paint with controlled pattern. Thousands of minute surfaces break up the light rays so that no highlights reflect into the operator's eyes. This approach to surface coating can be considered a functional use of paint, in addition to the sales and decorative factors.

The use of wrinkle paint is not new—its durability and economy have long been known—but some adjustments in painting techniques were necessary before it could be successful on the high-production electrostatic paint spray lines which Burroughs has used for several years.

Current production statistics reveal less than three percent of rejects on painting—an exceptionally low figure for this type of high quality surface coating operation. The low rate

of rejects is due to complete finish engineering from degreasing through baking and assembly.

Outlined below are some production data and information to illustrate the way Burroughs engineers, working closely with the paint and spray equipment suppliers, have set up their production operation.

Complete cleaning-phosphating-drying cycle in 19 minutes

The surface of all parts is first cleaned thoroughly, then phosphate coated for passivation and corrosion protection, next neutralized in a chromic acid dip, and then dried. The entire cycle, with intermediate rinses, requires only 19 minutes in a U-shaped, custom-built spray- Bonderizing unit, Figure 1.

All parts are racked on specially designed holders which serve to ground the castings and stampings for the electrostatic spray cycle. The same racks carry the parts all the way through the finishing operation so that it is not necessary to handle or rerack them. Although for certain of the smaller components, it has been possible to design "universal" racks capable of holding varying sizes, shapes and numbers of parts, most of those for die cast parts are custom made and generally involve an internal holder with outward tension against the walls of the casting.

Production scheduling is one of the most intricate detail jobs involved here—one phosphating line supplies parts for four painting and baking lines. Some parts get only a single coating of paint, while others get two or more coatings, depending upon the severity of service conditions.

First stage of the finishing cycle is cleaning of the metal surface. This is included in the unit shown in Figure 1. An emulsion type cleaner mixed with a mild alkali is sprayed on the castings from a bank of spray nozzles operating at 16 pounds pressure and 150F solution temperature. The combination of chemical solvent and mechanical action of the sprays, leaves a surface which is thoroughly clean.

A hot water rinse at 200F follows, and then the parts enter the Bonderizing spray. This process imparts a microcrystalline phosphate surface coating which is corrosion resistant when covered with enamel and forms a good paint bond. The phosphating solution is applied by spray nozzles in a period of between one and two minutes. Solution temperature is held between 150 and 160F.

3. TO REACH RECESSES AND INTERIOR SURFACES not coated by electrostatic methods, a manual spray booth is located next in line. Complete uniformity of coating thickness is necessary for controlled wrinkle pattern.

4. THE FINISHED CASTING, ready for assembly, has the uniform, fine wrinkle which eliminates glare. The small die cast trademark is inserted into a cored hole and attached with Speed Nuts before leaving the paint department.

Ferrous and non-ferrous processed together

An important feature of this process is its suitability for phosphating aluminum die castings on the same line with steel and iron parts. For this purpose, Bonderite #170 is used which is designed for

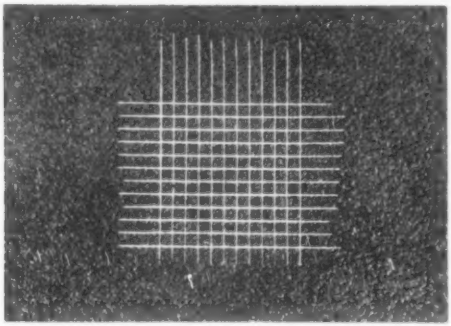
processing of several metals simultaneously.

Before the Parcolene neutralizing bath, the parts are once more rinsed, this time in warm water. It was found that a hot water rinse tended to set the phosphate salts too rapidly, so that for maximum effect of the Parcolene bath, rinse temperatures have been reduced. This neutralizing bath is a chromic-phosphoric acid solution maintained at 180-200F.

Solution control is relatively simple, and it is ordinarily unnecessary to check or replenish bath composition oftener than once in 24 hours.

From the neutralizing bath, the castings move through a gas-fired drying oven which accounts for about one-third of the entire cycle. Oven temperature is maintained at 300F.

Before any finishing treatment is accepted, Burroughs' quality control laboratories run a series of tests on completely finished test panels. Twelve lines are scratched 1/8 inch apart, and another set of lines is scratched at 90 degrees, cutting through to the base metal. The panels are then exposed to corrosive atmospheres to determine whether the surface corrosion is contained within the scratched lines, without spreading under the paint. The 1/8 inch squares of paint are then checked to locate any tendency toward loosening or peeling.



5. TEST PANELS LIKE THIS ONE are used before any finishing system is put into production. Lines are scratched through the paint and then the panel is subjected to corrosive conditions. Paint must adhere firmly around the exposed scratches.

Uniform paint coating is essential for uniform wrinkle texture

As mentioned previously, wrinkle paint with a fine texture was chosen

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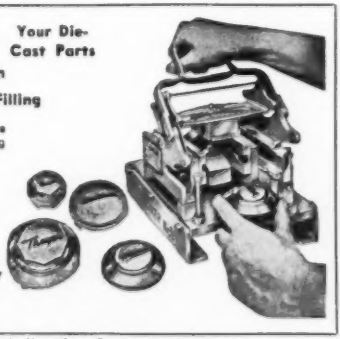

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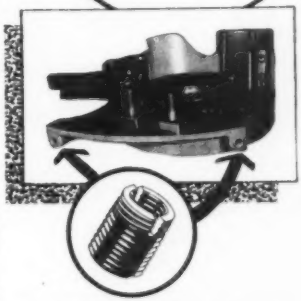
strengthen power tools--Chain Saws, for instance



THIS magnesium die cast housing is part of the Chain Saw manufactured by Homelite Corporation. Such tools must be strong in every part, to withstand rigorous use.

To strengthen the tapped threads indicated by arrows, Homelite uses Tap-Lok Inserts. They report that the Insert not only provides a dependable non-stripping fastening, but also acts as a lock on the screw, preventing it from vibrating loose during use.

The unique self-tapping feature of this hardened steel bushing also substantially reduces assembly costs by eliminating a separate tapping operation.

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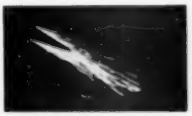
"61" WHEEL USERS ARE GETTING THESE DRAMATIC PRODUCTION RESULTS

Long-Life Cutting Action

Only the contact wheel is different in these two photos—same type of belt, same work, same surface speed, same camera exposure—but what a difference in cutting action!

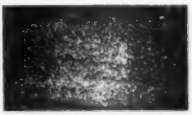


• Spark pattern at 24 minute mark using belt on standard serrated wheel.

• Spark pattern at 80 minute mark using belt on new "61" wheel.

Non-Glazing That's Amazing

Unretouched photos tell the story. Same belt—same work—different wheels. Imagine—the belt section pictured far right has already run more than *three times as long* as the other section—still has plenty of abrasive life left, still is unglazed!



• Glazing on belt after 24 minutes using standard serrated wheel.

• Non-glazing on belt after 80 minutes using new "61" wheel.

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by Burroughs for its non-glaring surface. Although this is generally regarded as an "economy" finish because it covers minor surface defects in castings without requiring polishing or grinding, the reasons for using it here are primarily functional. Actually, wrinkle paint posed certain problems in order to be adapted to electrostatic application.

In this process, a source of electrostatic high potential creates a strong field between the spray nozzle and part to be coated. The part is grounded through the rack and conveyor. The force of the field transforms the spray into charged particles which are irresistibly attracted to the grounded article.

Irregular shapes need manual spray touch-up

Housing components, however, are of irregular shape so that all surfaces are not equally distant from the field, especially recesses and reentrant angles. For smooth coatings of paint, this slight difference makes no difference, but the wrinkle pattern depends, in part, upon close uniformity of coating thickness.

Compensation for this slight variation has been made by running the paint at relatively low viscosities, by adjusting the arrangement of spray guns and by the introduction of a manual spraying operation used in conjunction with the electrostatic operation where deep recesses cannot otherwise be evenly coated.

The Ransburgh electrostatic paint spray booth, Figure 2, employs four spray guns, although only three of them may be necessary for certain parts. An operator attends the booth, making adjustments which may be necessary in arrangement of guns, pressures and speeds. Immediately adjacent, a manual spray booth is located so that the extra paint can be added, Figure 3.

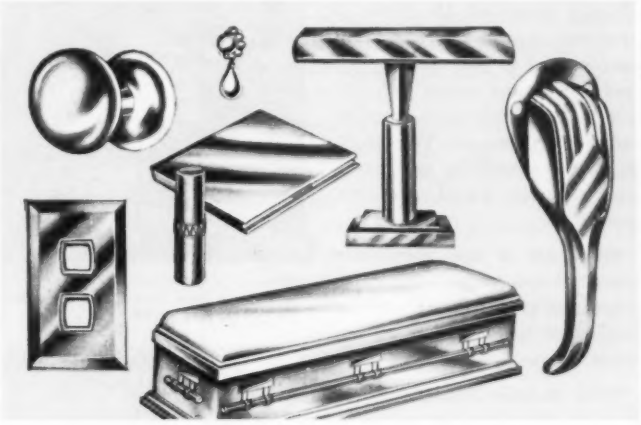
From the spray booth, the conveyor carries the pieces for about 15 minutes to allow set-up time before reaching the baking ovens.

The parts go through the oven in about 30 minutes, nearly the entire time at 310F. Temperature of the oven is raised 20F for bulky pieces, and therefore, these pieces are generally segregated and run through together for efficient operation.

Room temperature in the spray rooms is held at 80F. Paint viscosity varies from 18 to 28, depending upon the pieces being sprayed and individual conditions. Spray gun pressures are between 22 and 25 psi.

So far as possible, as many secondary operations as possible are performed in the paint department in order to avoid extra handling and consequent danger of nicking and scratching. For example, Burroughs company trademarks or insignia in the form of small die cast pieces, are inserted through cored holes and fastened with Speed Nuts before the pieces leave the department.

All-in-all, the finishing department at Burroughs represents a major production operation and occupies a large floor area. It is carried out with the same precision of controls, timing and materials-checking as is common practice in the fabricating, machining and assembly operations.



NOW... simulate copper, brass and bronze on products like these with M & W PLATELUSTRE

Don't let critical metals put a *needless* crimp in your production!

Take zinc or steel—apply a coating of one of the new PLATELUSTRE finishes. You wind up with products and parts that look so much like copper, brass and bronze that *the eye can scarcely tell the difference!*

Whether you have been using now unavailable copper and its alloys for *making* products or for *plating* products, you will find these new M & W finishes *equally* effective in keeping your plant running. There are types for air-drying and baking schedules—pick the one that best fits *your* production requirements.

Let an M & W Technical Service Engineer show you—*right in your own plant*—how easy these PLATELUSTRE coatings are to use, and what striking effects they produce. Or, if you prefer, write for free literature.

PIONEERS IN PROTECTION

MAAS & WALDSTEIN CO. 438 RIVERSIDE AVE. NEWARK 4, N. J.

Midwest Div.: 1658 Carroll Ave., Chicago 12, Ill. - Pacific Coast Div.: Smith-Davis Co., 10751 Venice Blvd., Los Angeles 34, Cal.

MANUFACTURERS OF INDUSTRIAL FINISHES

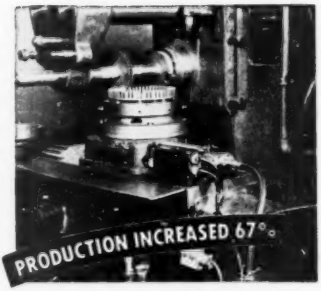
For additional information circle No. 77 on the Reader Service Card

ELECTRICALLY-CONTROLLED AIR POWER
Doubles the Output
OF STANDARD MACHINE TOOLS

YOU can apply Bellows electrically-controlled Air Power to practically any manually operated machine tool in your shop to (1) feed work to the cutting tool, (2) hold it, (3) feed the cutting tool to and through the work. You can do all three automatically, each movement properly timed, precision controlled.

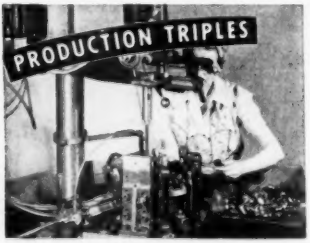
Experience of users everywhere proves you can double, often triple production from standard machine tools, with fewer rejects, less operator fatigue.

With Bellows "Controlled-Air-Power" units, your own tool room can convert your manually operated machine tools to fast automatic units, quickly, and at low cost.



Bellows "Controlled-Air-Power" Rotary Work Feed Table feeds difficult part to milling cutter.

Bellows Air Motors, installed on standard lathe to feed tail stock and operate cross slide, reduce auto maker's costs 50%.



Bellows "Controlled-Air-Power" installed on standard drill press to ream 7/16" hole, 1/4" deep, jumps production from 700 to 2000 parts per hour

Write for Bulletins
CL-15, DF-105, T-25
They'll point the way to faster, lower cost production in your plant. Write Dept. DC 252, The Bellows Co., Akron 9, Ohio.

The Bellows Co.
AKRON, OHIO
FIELD ENGINEER OFFICES IN ALL PRINCIPAL CITIES AND INDUSTRIAL AREAS

For additional information circle No. 72 on the Reader Service Card

SOLVENTS SHORTAGE HELD UNLIKELY

In the event grain becomes a more critical commodity in 1952, the nation's productive capacity will not suffer from a shortage of solvents as it did during World Wars I and II, according to a prediction from Saul Cantor, vice president of the United Lacquer Mfg. Corp. Mr. Cantor points out that new chemical chains of solvents made from petroleum products previously considered of no value will help forestall a solvents emergency like that of the two wars.

SPRAY MASK CONCERN APPOINTS TWO

In a continuing program of personnel expansion, Conforming Matrix Corp., Toledo manufacturers of electroformed paint spray masks and related devices, have announced the appointment of two engineers within the organization.

Elmer L. Faber has been appointed plant superintendent and head of the engineering department, and Milton T. Schimmel engineering sales manager.

Mr. Faber, who holds engineering degrees from Ohio Northern University and Columbia University, has served as tool engineer for American

Faber

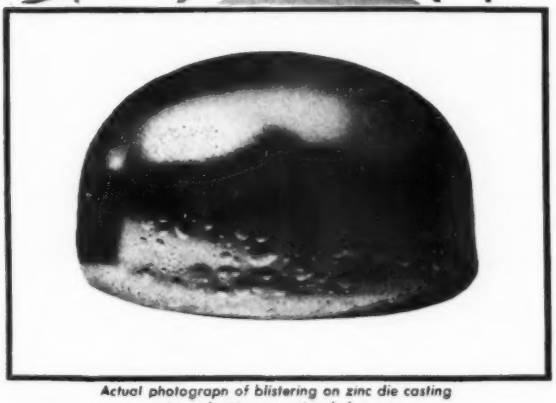
Schimmel

Propeller Corp., assistant master mechanic for Willys-Overland Motors, Inc., director of engineering for Ransome & Randolph Co., and chief of methods at Rossford Army Ordnance Depot, said to be the largest automotive special equipment repair parts depot in the world.

Mr. Schimmel, a specialist in mold design, was assistant chief engineer of Bowling Green Rubber Co. and superintendent of Manufacturers Enameling Corp., both of Toledo, before joining Conforming Matrix Corp.

BLISTERING, STREAKING

ON ZINC BASE DIE CASTINGS!



Actual photograph of blistering on zinc die casting cleaned with conventional cleaner.

Designed especially for reverse current electro-cleaning of zinc base die castings prior to electroplating, new Diversey No. 505 completely, safely removes all unwanted deposits! In addition, Diversey No. 505 conditions the surface of the zinc, providing better adhesion between the electro plate and the base metal!

This unique, double-action of Diversey No. 505 helps provide a uniformly clear, brilliantly lustrous finished surface . . . one free from blistering, peeling and streaking! Diversey No. 505 is economical, easy to use and available now! Investigate Diversey No. 505 today! *Mail the coupon for FREE copy of New Bulletin.*

DIVERSEY No. 505

NEW electro-cleaner and surface conditioner!

THE DIVERSEY CORPORATION
Metal Industry Department
1820 Roscoe Street • Chicago 13, Illinois
In Canada: The Diversey Corporation (Canada) Ltd.
Lakeshore Road, Port Credit, Ontario

THE DIVERSEY CORPORATION
Metal Industry Department
1820 Roscoe Street, Chicago 13, Illinois
Gentlemen:
Please send me complete information, including New Bulletin on Diversey No. 505.

*Name*_____
*Title*_____
*Company*_____
*Address*_____
*City*_____ *State*_____

For additional information circle No. 80 on the Reader Service Card

BRIGHT FINISHING SYSTEM

SPARKLES

LIKE CHROME!

Leading manufacturers approve zinc plate

and IRIDITE® Bright

to replace conventional chrome plating

If your problem is finding the right finish to replace conventional chrome plating, follow the lead of prominent manufacturers of all types of products . . . switch to zinc plate and Iridite Bright.

Here's what you get when you use this chromate finishing system to replace conventional chrome plating.

SPARKLING BRIGHT APPEARANCE

The zinc plate and Iridite Bright system resembles chrome so closely that visual inspection can scarcely tell the difference! And, the brilliance *lasts*.

BETTER CORROSION PROTECTION

Yes, you actually get better protection with zinc plate and Iridite Bright than with chrome plating . . . up to twice the life under accelerated salt spray conditions! And, by applying a clear baking lacquer over the Iridite coating you can increase the abrasion resistance and lasting qualities of this bright finishing system, at the same time making possible a greater salt spray protection.

LOWER FINISHING COSTS

One metal, zinc, replaces three so you save material costs and plating time. Iridite Bright goes on in a non-electrolytic chemical dip.

Write or call today for your copy of our new Technical Bulletin describing all phases of this bright finishing system in detail. Tell us your bright finishing requirements. If possible send sample parts for test processing.

Iridite is approved under government specifications

ALLIED RESEARCH PRODUCTS
INCORPORATED
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REPRESENTATIVES IN PRINCIPAL INDUSTRIAL CITIES; West Coast: L. H. BUTCHER COMPANY
Manufacturers of Iridite Finishes
for Corrosion Resistance and Paint Systems on Non-Ferrous Metals; ARP Plating Chemicals.

For additional information Circle No. 69 on the Reader Service Card

DR. WILLIAM BLUM RETIRES

Dr. William Blum, internationally known for his contributions to the field of electrochemistry, is retiring as Chief of the Electrodeposition Section of the National Bureau of Standards after 42 years service.

Dr. Blum has been responsible for NBS research and development in the field of electrochemistry since 1929. He came to the NBS in 1909 and has done research in electrodeposition, including electroplating, electrotyping, and electroforming. He has also contributed to the field of analytical chemistry.

Dr. Blum was born in Philadelphia, Pennsylvania in 1881. He received a B. S. in chemistry in 1903 and a Ph.D. in chemistry in 1908 from the University of Pennsylvania. From 1903 to 1909 he was an instructor and assistant professor of chemistry at the University of Utah teaching general, analytical, and physical chemistry.

His many technical papers reflect his contributions to the field of electrodeposition. He is the author of chapters in several corrosion handbooks and of the revised third edition of the text, "Principles of Electroplating and Electroforming" as well as other technical articles.

ASTE EXPOSITION TO SET NEW RECORD

Reports from headquarters of the American Society of Tool Engineers show that the number of exhibitors scheduled to be represented at the 1952 ASTE Industrial Exposition March 17-21 already exceeds the former record-breaking number at the 1950 exposition.

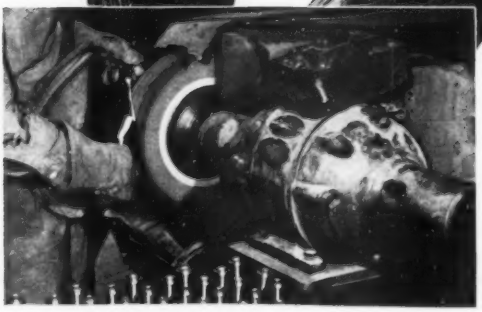
This year's show to be held in conjunction with technical sessions of the ASTE will be located in Chicago's International Amphitheatre. Simultaneous technical sessions and panel discussions are to be held on each of the feature days: Inspection and Quality Control Day, Metal Cutting Day, Materials Forming Day, Grinding and Finishing Day, and Machine Accessories, Drives and Controls Day.

Want a fine pre-plating finish?

● You get it quickly with LIGHTNING* METALITE Cloth Belts. A minimum of polishing is enough, because there are no wheel marks nor wild grain scratches to buff out. These abrasive grains are electro-coated sharp-end-up in a DURABONDED* coating. This ideal combination resists glazing, shedding, and loading. It's all fine cut and no rub with this belt.

The right combination of belt and contact wheel for maximum performance on your work is a question that your BEHR-MANNING Field Engineer is ready to answer. Why not check with him? Write us. Address Dept. PM-2.

BEHR-MANNING METALITE® BELTS



Want to polish contours?

● Nothing is so adaptable as a belt when it comes to polishing short or long radius curves, rounds, recessed contours. With the right contact wheel the belt will hug the work and deliver the smooth continuous polished surface that you want. There have been surprising developments in application of LIGHTNING METALITE Cloth Belts, especially in the polishing of inside contours, that may be of value in your work. Your BEHR-MANNING Field Engineer has the data and will be glad to assist you in your production.

CASE HISTORIES ON POLISHING

This booklet "Blueprints for Faster, Better Production," has a number of selected new abrasive applications that have saved time and money for their users, and may do so for you. Write for your copy today. Address Dept. PR-2.

® *Trademarks

BEHR-MANNING CORPORATION

division of NORTON Company

▲ COATED ABRASIVES
▲ SHARPENING STONES
▲ PRESSURE-SENSITIVE TAPES

Main Office and Plant: Troy, N. Y.
For Export: Norton Behr-Manning Overseas, Inc.

For additional information circle No. 72 on the Reader Service Card

UNICHROME Trade Mark

News about

COATINGS for METALS

Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Chromate treating costs reduced

with UNICHROME DIPS for zinc

A system for turning out good BRIGHT finishes

Despite shortages and restrictions, you can still turn out high quality bright finishes by turning to a *combination* finish. This consists of plating as allowed today, and then following up and fortifying the plate with a really tough, *clear* enamel.

United Chromium can help you with the *complete* system – the bright metal finish and the clear enamel. For example:

Unichrome Clear Dip Finish for zinc plate with an application of Unichrome Coating B-115 provides a system with excellent corrosion resistance and appearance similar to chromium.

Or . by depositing bright chromium from the Unichrome S.R.H.S.Chromium Bath over thin nickel or no nickel at all, and then using Coating B-115 for extra corrosion resistance, you'll also get a dependable bright finish.

Remember, in United Chromium you have the Company that knows *metal* finishes as well as their requirements in *coatings*. Consult us to learn how Unichrome *combination* finishes can solve your problem.

★

UNITED CHROMIUM, INCORPORATED

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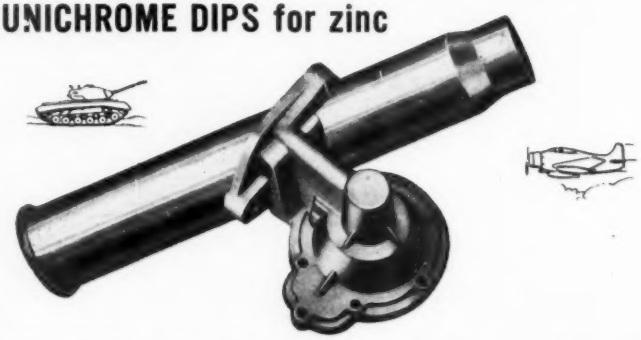
Detroit 20, Mich. • Waterbury 20, Conn.
Chicago 4, Ill. • Los Angeles 13, Cal.

In Canada:
United Chromium Limited, Toronto, Ont.



A large automotive supplier is producing a yellow, iridescent, corrosion-inhibiting finish on zinc these days with more ease and less expense. Since switching from a "home made" chromate solution to a Unichrome Dip, the Company reduced material costs alone by nearly a third. And there's less trouble getting as good or better corrosion resistance than specified.

As this case indicates, UNICHROME DIPS provide a means of meeting chromate treating specifications for both civilian and defense production with easy-to-use, long-life, economical solutions.

ANOZINC* is still another process used for chromate-treating of zinc. It's especially suited for mass production, where it offers even greater economies. **Trade Mark*

Dips Do the Job Chemically

The various Unichrome Dips form their conversion coatings *fast*. A simple 5-second to 2-minute immersion does it, producing a surface finish integral with the zinc. You can get *black, olive drab, brass-color, iridescent yellow,* or *clear* finish from solutions which are easy to control.

Anozinc Does It Electrolytically

Anozinc uses conventional plating equipment and gives you a chromate finish with superior corrosion resistance and extra toughness. Parts can be handled wet, eliminating need for drying time and space. Three Anozinc finishes available – *black, yellow* or *clear* – from solutions that have long, trouble-free life.

* * *

Shell cases, propeller blades, bolts, screws, pump and carburetor die castings and many other parts are today getting the benefits of one of these Unichrome Dip or Anozinc finishes. If you want an economical answer to your own finishing problem, investigate them. Write for data.

Acidproof Tantalum cuts costs in heating acid solutions

Acidproof to all plating solutions except hydrofluoric acid, the tantalum piping used in Unichrome Heat Exchangers and Coils has thin wall sections that promote more efficient heat transfer. Immune to attack, this tough tantalum heating and cooling equipment lasts longer, builds up no heat insulating deposits, and reduces servicing downtime to bed rock.

Get the DC you need now – with a RECTIFIER

Unichrome Selenium Rectifiers, in sizes from 250 up to 10,000 amperes, are now ready to supply dependable, unfailing power for electroplating and anodizing. Ruggedly built for long service, they are now available for fast delivery.

For additional information circle No. 79 on the Reader Service Card

PMM USEFUL LITERATURE

PROCESSES

How to Use Tungsten and Molybdenum: No. 145
In a booklet, "Fansteel Tungsten and Molybdenum" the Fansteel Metallurgical Corp. of North Chicago, Ill., provides a great deal of basic information on these metals and their uses. Primary method of forming or fabricating these metals is the powder metallurgy process.

Detailed Study of the Croning Process: No. 146
A 20-page booklet from Bakelite Co. a Division of Union Carbide and Carbon Corp., offers a complete review of the Croning Process for producing thin shell sand molds. Accompanied by step-by-step photos, the book surveys fundamentals of the process from mixture preparation down through the finished Casting. A bibliography is also included.

Through All Departments of a Die Casting Plant: No. 40
In a new booklet, "The Inside Story of New England's Largest and Most Modern Die Casting Plant," the New England Die Casting Company offers a pictorial department-by-department tour of its facilities.

Die Castings for Defense: No. 5
A booklet published by Advance Tool and Die Casting Co. is "We're Geared for Your Defense Needs" and explains how the Advance Tool facilities can be utilized for defense production.

Full color illustrations of investment casting: No. 6
A colorful folder published by the Microcast Div., Austenal Laboratories entitled, "12 Steps in the Microcast Process," has a series of carefully drawn illustrations showing the production of an investment casting. Each step is briefly described along with the full color pictures.

MATERIALS AND EQUIPMENT

Non-Ferrous Surface Hardness Determined Rapidly: No. 155
A new technique for determining surface hardness of non-ferrous castings, extrusions, etc. with split-second speed is the subject of a colorful, informative folder from Peabody Industries, Detroit. Instrument employed is a pocket-sized, direct-reading unit weighing less than 5 oz.

Prepared Gas Atmospheres: No. 156
A new illustrated bulletin on industrial applications of gas chemistry for heat treating has been released by Surface Combustion Corp. Exothermic and endothermic type atmosphere generators are described and the gas generation processes schematically diagrammed. Gas constituents, generator capacities, application data and operating costs are tabulated.

Self-Compensating Toggle Clamp on New Die Casting Machine: No. 29
A patented toggle clamp arrangement which automatically takes up clearances in die casting dies due to contraction or expansion of the molds during production or shut-down is a feature of a new line of die casting machines introduced by Lake Erie Engineering Corp. A complete specification book on these machines is offered.

FINISHING

Drill Feed Operates on Air Pressure: No. 165
A positive control is provided by a new air operated drill feed described in literature from The General Pacific Corp. The drill feeds are reported to be adaptable to most drill presses, operate on ordinary shop air pressure and do not interfere with manual operation.

Taps Designed Specifically for Zinc, Aluminum, Etc.: No. 167
In a 32-page manual, Detroit Tap & Tool Co. presents its line of "Specific Taps" designed for use with various materials. There is a separate section in the manual for each of the following materials: zinc die cast metals, aluminum, brass, cast iron, steel & tough materials, plastic & Bakelite.

Vapor Degreaser Operates at High Vapor Temperature: No. 168
Automatic thermostatic control maintains a high vapor temperature of 250.2F in Phillips vapor degreasers, described in a new bulletin from Phillips Manufacturing Co. Complete line of standard and special models are illustrated.

How to Pick the Right Buffs for 24 Different Materials: No. 169
A valuable feature of a new leaflet called "The Key to Your Finishing Problems" published by United Buff Products Corp. is a chart of buff recommendations covering 24 different materials. Buffs are recommended for both cutting and coloring operations, manual and automatic. A chart of buff speeds in relation to buff diameters is also included.

Complete Data on Rotary Work Feed Tables: No. 170
Enough data to enable the tool designer or production engineer to plan a complete rotary work feed installation are contained in a new Bulletin T-85 from The Bellows Company. This booklet contains thorough diagrams of the construction of these Bellows rotary work feeds, with wiring diagrams, instructions on methods of locating fixtures, specifications and suggestions of ways in which they can be integrated into production operations.

Thread Cutting Screws — Slotted & Phillips Head: No. 171
Information and price lists for thread cutting screws can be obtained from Pheoll Mfg. Co. who furnish them in slotted or Phillips recessed head types. Also included a full line of screws, bolts and nuts.

Die-Cut Masking Tape: No. 172
Custom die-cut masking tape cut from pressure-sensitive Scotch tape for use in spray painting is supplied by Panoco, Brooklyn, N. Y. Prices and samples are available.

Mechanical Deburring, Polishing with Roto-Finish: No. 173
A booklet divided into five sections tells in detail how the Roto-Finish process can be used for deburring, descaling, polishing, britehoning and coloring of intricately shaped products. In addition to a description of the barrel finishing process, the booklet deals with the finishes obtainable, how to select the proper machine and chips, and some typical finished parts.

Self-Locking Tubular Spring Type Fastener: No. 174
A heat-treated tubular slotted dowel pin called the Sel-Lok Spring Pin is the subject of a catalog from Self Lock Fastener Corp. The hollow pin with chamfered ends becomes compressed as it is driven or pressed into the hole and remains tight against vibration. Pins can be removed and reused.

Cold Spray Phosphating Eliminates Preliminary Steps: No. 175
A new cold spray bonding solution for preparing metal surfaces for finishing has been introduced under the name Phospray by the Du-Lite Chemical Corp. Literature about the solution says that it can be applied with ordinary spray equipment and dispenses with preliminary steps such as cleaning, rinsing.

Cowles

SM CLEANER

a non-foaming cleaner

for 1 . . . use as an electrocleaner (cathodically, anodically) on steel when exceptionally high current densities, tank design or type of work tend to produce excessive foaming.

2 . . . use as a detergent in all types of washing machines for die castings, steel, brass and copper.

Because it is formulated with water conditioners, Cowles SM Cleaner is especially effective under hard water conditions.

prompt shipments from convenient warehouse stocks

COWLES TECHNICAL SERVICE
gladly furnished upon request

COWLES CHEMICAL COMPANY
METAL CLEANER DEPARTMENT
7016 EUCLID AVENUE • CLEVELAND 3, OHIO

For additional information circle No. 75 on the Reader Service Card

PMM NEW PRODUCTS

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail — no postage is required.

NEW DIE CASTING DIE STEEL COMBINES HIGH STRENGTH WITH EASY HOBBING

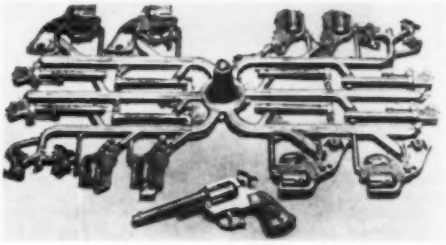
Super Samson
The Carpenter Steel Co.

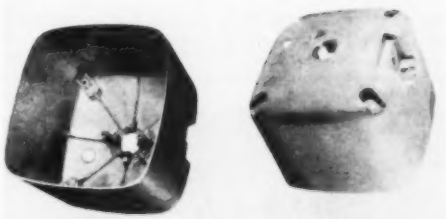
SPECIAL FEATURES: A die casting die steel that appoaches the hobbing ease of regular hobbing irons yet compares favorably with the high strength of 5% chrome hot work die steels is announced. Developed primarily for applications involving die casting of aluminum and zinc. Reported to be 50-60% as easy to hob as soft hobbing irons, yet resists heat and abrasion, to provide more economical die sinking, particularly for duplicate cavities. Hardens uniformly in dies with wall thicknesses up to at least 4". Illustrations ***right*** show great surface detail and unusual size of die castings produced from cavities hobbed in this steel. Forged blank for large casting measured 16x16x10" and the finished cavity is 8" square by 5" deep. About 14 pushes were required to reach this depth, plus two for closing. Bottom relief was used during hobbing and the die was annealed after each push.

SPECIFICATIONS:

Mechanical Properties and Heat-Treatment	Super Samson Type Analysis: Carbon .10%, Manganese .30%, Silicon .20%, Chromium 5.00%, Molybdenum .90%, Vanadium .25%		Die Steel Containing 0.40 Per Cent Carbon, 5 Per Cent Chromium, 1.35 Per Cent Molybdenum, 1 per Cent Vanadium	
	At Room Temp.	At 800 Deg F.	At Room Temp.	At 800 Deg F.
Hardness, Brinell (as annealed)	125	—	220	—
Heat-Treatment Air-cooled from a temperature of	1750 Degrees F.		1850 Degrees F.	
Draw temperature	800 Degrees F.		1050 Degrees F.	
Tensile strength, pounds per sq in.	187,000	183,400	235,000	231,000
Yield point, pounds per sq in.	150,000	146,500	208,000	206,000
Elongation in 2 inches, per cent	15.8	19.4	10	11
Reduction of area, per cent	53.4	55.8	38	39.5
Charpy V-notch impact, foot-pounds	32	40	4.5	20.5
Hardness, Brinell	390	....	450	....

For additional information circle No. 105 on the Reader Service Card





MASKING TAPE FOR ANODIZED LIGHT METALS

No. 113 Behr-Cat Brand Masking Tape

SPECIAL FEATURES: Designed especially for the difficult operation of masking off areas on anodized aluminum and magnesium as well as castings of these metals and their alloys, particularly where such parts are to be subjected to high temperatures.

For additional information circle No. 106 on the Reader Service Card

PLASTER CORES CAST IN PLASTIC MOLDS

Tool-Plastic
Rezolin, Inc.

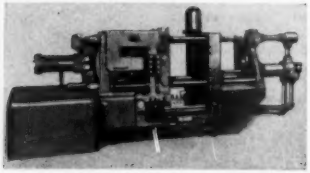
SPECIAL FEATURES: Plaster cores for impeller blade assemblies are being cast in a new type of mold cast from a thermosetting liquid phenolic plastic known as Tool-Plastic. Dental stone was formerly used for casting the plaster cores, but the new plastic molds are reported to have yielded an increase of over 1300% in parts produced per tool. One company is said to have produced over 20,000 cores to tolerances of .005 per inch using Tool-Plastic molds, without appreciable mold wear. Costs are reported reduced fom $16 per 100 for cores to about one cent apiece. Possibilities for use in the plaster mold casting field are believed to be extensive.

SPECIFICATIONS: Smooth surface of plastic mold can be readily reworked; minor repairs of surfaces can be effected by labor which is not highly skilled. Sterene, the medium of separation used in casting plaster cores, must be applied to stone molds after each cast, but Tool-Plastic molds require regreasing only after three or more cores have been cast.

For additional information circle No. 107 on the Reader Service Card

IMPROVED SHOT PLUNGER FOR ALUMINUM AND MAG "PREFILLS" DIE CAVITY

Model 1½G & 2G Cold Chamber Die Casting Machines
Reed Prentice Corp.



SPECIAL FEATURES: Plunger speed of 10,000 inches per minute — required especially for magnesium die casting — is attained through a 3-inch 2-way valve integral with the "shot" cylinder and by incorporating a prefill arrangement. With this, the plunger moves at low pressure until the mold is filled, at which time maximum pressure is applied instantaneously to produce more perfect castings.

SPECIFICATIONS: The #1½G machine develops 250 tons die locking pressure and die casts aluminum parts weighing up to 3.75 lbs. and magnesium parts up to 2.4 lbs. The #2G machine provides 400 tons clamping pressure and has a shot capacity of 9 lbs. aluminum and 6 lbs. magnesium. Both the #1½G and 2G machines have four tie-bar construction and a sliding support bracket for the movable die plate to maintain proper die alignment under continuous operation. Die plates on the #1½G model measure (VxH) 32"x29" while the 2G machine offers 38"x36" platens.

For further information circle No. 108 on the Reader Service Card

PHENOLIC LINING FOR VAPOR DEGREASERS

Detrex FF-1
Detrex Corp.

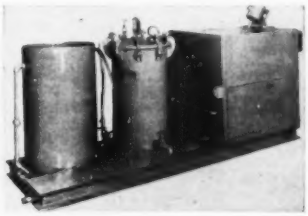
SPECIAL FEATURES: Non-porous, phenolic type coating for the inside of their line of hand-operated, solvent vapor degreasers has been tested for several years under severe operating conditions and is reported to give service life comparable with that of machines fabricated from expensive nickel clad steel. Impervious to trichlorethylene and perchlorethylene, and strongly resistant to chemical breakdown from water-solvent mixtures and relatively strong solutions of acids and alkalies.

SPECIFICATIONS: Completely polymerized, non-porous, interlocking with the surface of the metal, thereby preventing spread of corrosion under the film if the coating becomes damaged by physical abuse during service. To repair coating, the damaged area is abraded with fine steel wool or emery paper, apply FF-1 by brush, and blend the coating by heating with alcohol torch.

For further information circle No. 109 on the Reader Service Card

MACHINE SEALS LEAKING OR WEEPING CASTING

M-30 Mogullizer
Metallizing Company of America



SPECIAL FEATURES: Sealing castings having minute porosity, fissures or pinholes accomplished quickly under high vacuum. Reclaims expensive ferrous or non-ferrous castings. Pressure castings sealed by this method ae reported by the manufactuer to have been subjected to solutions of hot oil or kerosene under pressures as high as 10,000 psi to test sealing effectiveness.

SPECIFICATIONS: Capacity 4½ cu. ft.; floor space required, 36" x 100"; weight, 850 lbs. Castings are placed in unit's sealing tank and subjected to 29½" vacuum for 20 minutes to remove air and moisture from their inner walls. Next, an impregnating solution such as Mogul Cast Seal Colloidal is introduced into the vacuum tank, followed by application of 100 pounds air pressure for another 20 minutes, forcing the solution into the casting walls from all directions. Castings are removed and rinsed in water. Cost of Mogullizing castings is said to vary from 1/5 of a cent to three cents per pound, depending upon their bulk.

For further information circle No. 110 on the Reader Service Card

IMPREGNATED POLISHING CLOTHS FOR METAL

Rollies
Embree Mfg. Co.

SPECIAL FEATURES: For final polishing and cleaning on cast metal hardware parts and similar metal products. The required ingredients and the vehicle of application are combined in one unit.

Which job would you like to improve?

Listed below are some jobs discussed in Oakite's new 44-page illustrated booklet on Metal Cleaning. Let us help you do them with better results, greater economy.

OAKITE PRODUCTS, INC., 34G Thames St., New York 6, N. Y.

Tell me (without obligation on my part) about Oakite methods and materials for the following jobs:

- ☐ Tank cleaning
- ☐ Machine cleaning
- ☐ Electrocleaning
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- ☐ Pre-paint treatment
- ☐ Paint stripping
- ☐ Steam-detergent cleaning
- ☐ Barrel cleaning
- ☐ Burnishing
- ☐ Rust prevention
- ☐ Send me a FREE copy of your booklet "Some good things to know about Metal Cleaning"

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COMPANY .....

ADDRESS .....

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE SPECIALIZED INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

For further information circle No. 78 on the Reader Service Card

Reported to save expensive compounds by feeding to the working surface at constant predetermined rate for maximum efficiency.

SPECIFICATIONS: Made of cotton (other fibrous materials on request) impregnated with any of a variety of polishing, buffing, oiling or other compounds. Rolled in cellulose tissue with both ends exposed for use.

For additional information circle No. 111 on the Reader Service Card

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TOOL REMOVES TANG FROM HELICAL WIRE THREAD INSERTS

Automatic Tang Break-Off Tool

Heli-Coil Corp.

SPECIAL FEATURES: Complete line of automatic tang break-off tools for the removal of inserting tangs on helical-wire thread inserts. Tool works on principal of spring-loaded center-punch, removing tangs quickly without disturbing the inserts.

SPECIFICATIONS: Made in 14 standard models for tang removal at production rates on the following sizes and lengths of stainless steel Heli-Coil thread inserts: 6-32 to ½-13 sizes in the National Coarse thread series to lengths of 1, 1½ and 2 diameters; and 10-32 to ½-20 sizes in the National Fine thread series to the same lengths. For other sizes and lengths of inserts, special punch assemblies (interchangeable with standard handles) can be supplied.

Heli-Coil thread inserts provide durable female receiving threads in aluminum, brass, copper, magnesium, plastics, iron, steel, zinc and wood. Their uses in the protection and repair of tapped threads fall into three categories: original equipment manufacture, production salvage, and maintenance.

For additional information circle No. 112 on the Reader Service Card

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ALL-PURPOSE METAL CLEANER

Magnus 751

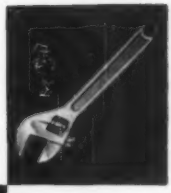
Magnus Chemical Co.

SPECIAL FEATURES: Safe for all metals, reported not to attack, pit or mar aluminum alloys, die cast metals, bearing metals, etc.; non-inflammable; high speed cleaning; long life of cleaning solution.

SPECIFICATIONS: Used hot or cold, followed by simple coldwater rinse after the cleaning period. Work can be placed in cleaning and solution and left without damage. Also strips paint and other coatings from parts that are being cleaned.

For additional information circle No. 113 on the Reader Service Card

From finishing hand tools . . .



to sanding forged aluminum

Armour Backstand Belts do the job right

For the thousand-and-one jobs the backstand belt can do easily and profitably, for the other thousands of jobs coated abrasives do so well, Armour has the answer—there's an Armour coated abrasive to do *your* job right.

Toledo Steel Tube Co. saves time

2 hours per operation per day—that's the time the Toledo Tube Co. saved by switching to backstand belts. In removing burrs and grip marks from tubing, they found Armour Coated Abrasives cut faster, last longer, give a better finish.

Armour has one of the most modern plants in the coated abrasives industry. Belts are only one of the many forms of coated abrasives available to you — more than 30,000 different varieties in grip size, backing, etc. Sheets, rolls, discs, tubes — and specialty sizes to meet your specifications, if you need them.

Conserve your stocks of coated abrasives. Write for our free booklet on "How to Store Coated Abrasives."

We recommend buying through your industrial distributor

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Title.....

Firm.....

Address.....

City..... Zone..... State.....

For additional information circle No. 71 on the Reader Service Card

REFERENCE MATERIAL, catalogs and data offered free in this month's ads (circle numbers on reader service card.)

3. DIE CASTING FACILITIES of the Admiral Die Casting Co. are described in an illustrated booklet available from the company.

5. DIE CASTINGS FOR defense is the subject of a booklet, "We're Geared for Your Defense Needs" from Advance Tool & Die Casting.

6. PERMANENT MOLD CASTING facilities of Aluminum Industries, Inc. are presented in a new illustrated booklet.

12. CONSULTATION SERVICE and complete light metals testing offered by Christiansen Corp. are described in "Quality Increases Sales."

13. COMPLETE SPECIFICATIONS for the high speed Model 400 die casting machine are offered by Cleveland Automatic Machine Co.

21. SMALL DIE CASTINGS are discussed in brochure, "How Small Is Small?" from Gries Reproducer, specialists in small die castings.

24. DIE CASTING PLANT of the Hoover Co. is the subject of a folder showing complete facilities.

25. DESIGNING FOR POWDER metallurgy is the subject of an engineer's handbook from International Powder Metallurgy.

26. THE HOW & WHY of investment casting is explained in an illustrated leaflet from Investment Casting Company.

27. TILTING ELECTRIC FURNACES for production & laboratory use are depicted in literature from Kuhlman Electric Co.

28. DIE CASTING MACHINES are the subject of a folder from the Kux Machine Co. showing small vertical and horizontal units with 1½ lb. capacity.

31. HOW TO DESIGN aluminum and magnesium die castings is the subject of a data book from Litemetal Dicast, Inc.

33. OIL LINE FILTERS for hydraulic and low pressure circuits are described in literature offered by Marvel Engineering.

34. PATENTED FEATURES included in a line of die casting machines are covered in a new catalog from Lake Erie Engineering.

35. CURING LEAKY CASTINGS by the Mogullizing treatment is described in a book from Metalizing Company of America.

37. FACT FILE pertaining to aluminum permanent mold & die castings, and zinc die castings is offered by Monarch Aluminum.

38. SAFE HYDRAULIC FLUID for die casting machines is the subject of a booklet from Monsanto describing Pydraul F-9 fluid.

40. FACILITIES of the New England Die Casting Co. is described & illustrated in a booklet.

41. DIMENSIONING DIE CASTINGS is an important engineering handbook for designers, compiled and issued by Newton-New Haven Co.

49. CUTTING COSTS by heat exchange is outlined in a catalog from Ross Heater & Mfg. Co. whose equipment reduces hydraulic fluid temperatures.

54. HOW TO HEAT WAX for making investment casting patterns is the subject of a booklet from Sta-Warm Electric Co.

56. MELTING & HOLDING furnaces for magnesium & aluminum are covered in a bulletin from Stroman Furnace.

58. COMPLETE DIE CASTING service, from engineering through assembling is described by Tri-State Die Casting in a catalog.

61. PLASTER MOLD castings are discussed in catalog from Universal Castings telling about the process, alloys, physicals and typical parts.

62. MACHINES FOR MOLDING polystyrene patterns for investment casting are presented in a ment casting are in a catalog from Van Dorn Iron Works.

65. SPECIFICATIONS for the Cast Master die casting machines are presented in a catalog from Miller-Taylor.

66. MELTING FURNACES in large or small capacities are illustrated and described in literature from Eclipse Fuel Engineering.

67. MACHINE FOR DIE castings one pound or less is the subject of a catalog from A.B.C. Die Casting Machine Co.

69. BRIGHT FINISHING SYSTEM to replace decorative plating is explained in literature from Allied Research.

70. BARREL FINISHING: process, equipment and materials are fully explained in literature from Almco Div., Queen Stove Works.

71. STORING COATED ABRASIVES, a practical guide for

Continued on page 76

31-POUND CASTING
continued from page 39

battery of melting furnaces. Temperature controls on the furnace keep metal at proper pouring range to facilitate the production of castings that are uniform, precise dimensionally, free from shrinks and porosity, and pressure tight.

The mold and machine cover an area 4' wide x 10' long x 5½' high. The hydraulic power of the machine is used for clamping the book type mold together to eliminate flash and overweight castings, to open the mold halves on a timed cycle and to eject the castings to the two operators. The cores for the internal ports are manually collapsed by a pinion arrangement. 2 men are able to cast 80 oil pans in an 8 hour shift.

The aluminum oil pan castings made by the permanent mold process are superior in appearance and in physical

For additional information circle No. 18 on the Reader Service Card

DIE CASTINGS by FEDERAL
ALUMINUM and ZINC

MODERN TOOLROOM
•
COMPLETE FACILITIES

LICENSED PRODUCER

New and improved cold chamber casting equipment at FEDERAL now produces larger than average aluminum die castings of superior quality. Consult us before making your decisions!

FEDERAL-built dies and high pressure casting equipment with water hydraulic injection assure GREATER DENSITY and BETTER FINISH.

PRECISION • COMPLEXITY
STRENGTH • ECONOMY

FEDERAL DIE CASTING CO.
2220 NORTH ELSTON AVE. • CHICAGO 14, ILL.
Phone ARMitage 6-4803

ECLIPSE MELTING FURNACES

DESIGNED ESPECIALLY FOR DIE CASTING

Known and respected wherever the melting of tin, lead, zinc, aluminum or magnesium alloy is required, Eclipse Melting Furnaces are favorites in the die casting field.

Furnaces can be furnished with cast iron, steel, chrome coated steel, or alloy iron, depending on the metal to be melted.

Furnace setting is lined with 4½" first quality firebrick and 2½" block insulation. Refractory bottom is tapered toward run out opening.

Gas fired flame retention-type burners with preburned tuyere blocks and continuous burning pilots locate heat at points of maximum heat transfer.

The McKee Low Pressure Proportional Mixer provides proper Air-Gas ratio at all times. The result is high production and low maintenance costs.

All furnaces can be equipped with roll around door type hoods and removable covers for easy accessibility of pot replacement. Write us for Bulletin C-1A.

Representatives in principal cities.

The Eclipse SM-22 Melting Furnace (at left), with a pot size 22½ by 14¼ inches, has a pot capacity as follows: tin, 1100 lbs.; lead, 1800 lbs.; zinc, 1170 lbs.; aluminum, 440 lbs. Other sizes available, both larger and smaller.

R-2170RR

Eclipse Fuel Engineering Company
ROCKFORD 1123 BUCHANAN STREET ILLINOIS
McKee Eclipse

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BETTER METHODS
SUPER CAST
DIE CASTINGS
BETTER DIE CASTINGS
SINCE 1919

The meaning of a signature!

Through a quarter of a century of knowing how, the SUPER CAST reputation for Better Methods—Better Die Castings, has been recognized.

Sound engineering, metallurgical knowledge and skilled techniques have achieved and maintained a standard of superior quality.

SUPER CAST has kept faith, always deserving the mark it bears. SUPER CAST means die castings for those who want the best.

A sound, time-tested institution and a sound time-tested product have won confidence and widespread endorsement.

DEPENDABLE
BETTER METHODS
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BETTER DIE CASTINGS
SINCE 1919

THE SUPERIOR DIE CASTING COMPANY

1001 London Road CLEVELAND 10, OHIO

Detroit Chicago Pittsburgh
Philadelphia New York

For additional information circle No. 57 on the Reader Service Card

properties to those made in sand molds. The inside surface of the castings produced in permanent mold is as clean, smooth and uniform as a precision cast part. The dimensional tolerances are held to ± .015 and weight is uniform at 31 pounds.

The success attained in producing this oil pan in permanent mold gives encouragement in producing other large castings of this type in permanent mold. It marks the progress being made by industry in using precision casting to increase production and

UNDERCUT INTERIOR HOLES for oil drain-back can be formed by collapsible, pinion-operated coring, or by knockout cores. Arrows indicate holes.

Design suggestions for large permanent mold castings

For designers interested in planning large permanent mold castings, a few pointers are offered:

- The more uniform the wall section, the easier it is to cast.
- A flange which can serve for ejector locations will help in releasing large, deep castings.
- Many holes can be cored. This includes mounting holes. side openings and holes formed by separate core pulls.
- Shallow castings require ejector spots quite uniformly distributed to avoid warpage.
- Special, hydraulically-operated dies are necessary, but tooling can easily be justified by improved production rate, accuracy and metal structure.

PMM INDUSTRY NEWS

AMERICAN ZINC EXPANSION TO ADD 7200 TONS TO ANNUAL OUTPUT

An increase in slab zinc output totaling 7,200 tons will result from an expansion program resulting from an agreement between the Defense Materials Procurement Agency and American Zinc Co. of Tennessee.

Under terms of the agreement, the company which is a subsidiary of American Zinc, Lead & Smelting Co. of St. Louis, will begin an expansion program cost of which will reach 7,200 tons annually

The government agency has agreed to purchase up to 300 tons of the slab zinc per month at a 17½ cents per pound figure if the company is unable to sell it to commercial users at a higher price.

The metal will be produced from the company's ore deposits near North Friends Station, Tenn.

ECLIPSE FUEL MOVES INTO PLANT; AREA IS TRIPLED

EXTERIOR VIEW of the new factory and office building recently completed and occupied by Eclipse Fuel Engineering Co.

Eclipse Fuel Engineering Company has just moved into its new, modern factory and office building which occupies an entire city block on Buchanan St., in Rockford, Ill.

Occupation of the new plant marks a high point in the 45-year-old company's major expansion program aimed at increased production to satisfy demand, as well as to consolidate Eclipse's formerly scattered manufacturing units.

The newly built plant has 92,500 square feet of floor space all one level and is triple the plant's former area. Other developments planned as part of the expansion program are the addition of oil-firing devices to the company's line of gas-fired equipment, and the erection of a testing laboratory for combustion research on a site near the new plant.

Activities coordinated in the new, enlarged building include the building of heat treating and melting furnaces, construction of steam boilers, fabrication of combustion accessories such as burners, valves, blowers, governors and diluters, and the distribution of meter parts and accessories.

FABRICATING FURNACE PARTS in the new Eclipse Fuel Engineering plant.

ADMIRAL DIE CASTING APPOINTS SALES HEAD

Appointment of Fred Friedlieb as sales manager of Admiral Die Casting

Fred Friedlieb

Corporation, 200 West 83 St., Chicago 20, Ill., has been announced by Henry Kleifgen, president.

Mr. Friedlieb, for five years previously, was sales representative for R. H. Campbell Co., Chicago, and was buyer at Motorola, Inc.

R. L. WILCOX LEAVES ECA FOR AMERICAN SMELTING

Ralph L. Wilcox, chief of the Non-Ferrous Metals Branch of the Economic Cooperation Administration, is returning to private industry to assume an executive post with American Smelting and Refining Corp.

Mr. Wilcox, who was vice president in charge of sales and engineering at Gerity-Michigan Corp. prior to joining ECA in September 1948, is well known throughout the die casting industry. He is the author of a number of articles on various phases of the die casting process, and a booklet "Die Casting with Zinc Base Alloys."

Mr. Wilcox assumed an executive post in the sales department of A.S. & R. effective January 1, and will make his headquarters in New York.

PRESIDENT OF VAN DORN IRON WORKS DIES

Norton T. Jones, president and chairman of the board of the Van Dorn Iron Works Co., died at his home December 18 at the age of 71. He had been head of the Cleveland company since 1938.

He was one of the organizers of the Superior Screw & Bolt Mfg. Co. and became president of that company in 1928.

SONKEN-GALAMBA RETURNS TO NORMAL OPERATION THREE MONTHS AFTER FLOOD

When Sonken-Galamba's officials and office workers moved back into their 2nd and Riverview building on November third, it marked the end of a three month fight to rebuild their 17 acre plant in Kansas City, Kansas.

Sonken-Galamba's aluminum production, steel fabrication, and warehousing operation was one of the many Kansas City firms hit hard in the July flood disaster. On July 13, Sonken-Galamba's production came to a complete standstill, as flood waters fourteen feet deep rolled in to cover the whole 17 acres of the plant.

Production workers immediately began the gigantic task of rebuilding production facilities, and worked so quickly that Sonken-Galamba was in limited production less than three weeks after the flood.

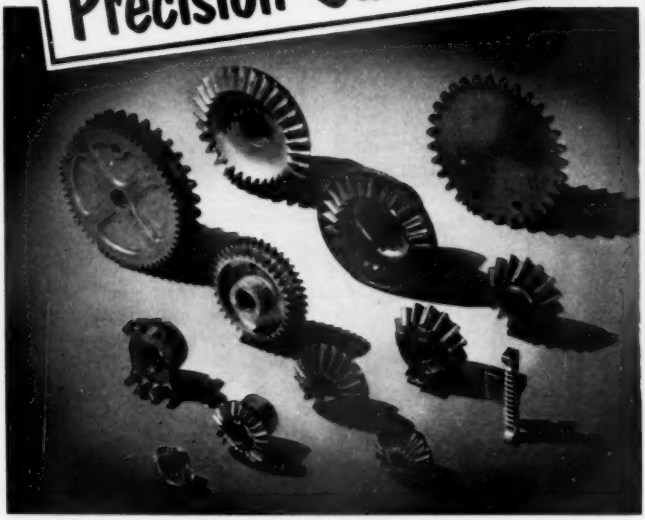
WORKERS BEGIN the gigantic task of cleaning up one of the silt and mud covered offices in Sonken-Galamba's 60-office building after the flood.

THE SAME OFFICE, three months later: officials and office workers have moved back after carrying on all operations temporarily from the 11th floor of the Pickwick Hotel in Kansas City.

After production facilities were cleaned out, attention was turned to the buildings. Not one building on the 17 acres could be used as it was left after the flood. Every building had to be either completely renovated from the inside, or torn down and rebuilt.

The brass and aluminum furnaces have been rebuilt, and are now larger

Need Small Precision-Cast Gears?



SPECIFY UNIVERSAL plaster mold precision castings and cut costly machining operations . . . reduce manufacturing costs. Plaster mold gears are sound, clean castings, produced to meet your individual requirements and specified tolerances. Universal has developed the plaster mold process to use aluminum bronze, magnesium bronze and all non-ferrous alloys. Castings made by Universal have unlimited applications in all types of equipment transmitting power and motion. Your particular precision cast problems may be economically solved by plaster mold castings. We invite your inquiries.

You get these outstanding properties when you specify Universal plaster mold castings:

- High Strength
- Fine Detail
- Close Tolerance
- Non-Corroding
- Non-Porous

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UNIVERSAL CASTINGS CORP.

5821 W. 66th Street • Chicago 38, Illinois

For additional information circle No. 61 on the Reader Service Card

than before and the most modern available. All laboratory equipment has been replaced with new equipment, which includes two of the most modern Spectographs available. Production has been considerably increased.

By the end of October, full production was resumed at Sonken-Galamba.

NAMED DOLLIN REPRESENTATIVE

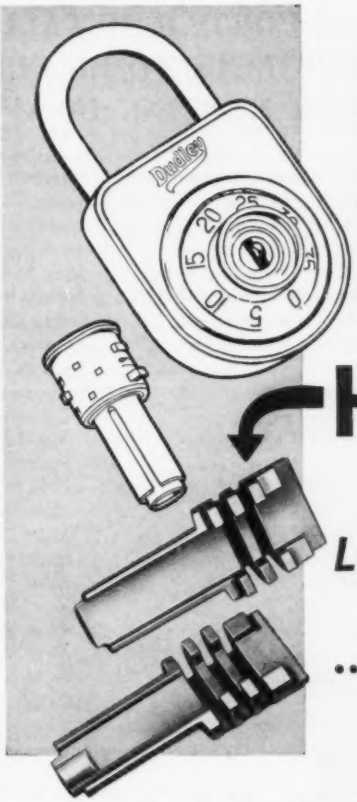
Philip Dollin

The Dollin Corp., die casting manufacturers of Irvington, N. J., announce the appointment of Philip Dollin, 209 Rosemary Lane, Germantown, Penna., as Dollin representative for the Eastern Pennsylvania Maryland and Delaware areas. Mr. Dollin's die casting experience includes many varied engineering, management and sales responsibilities at the Dollin plant, and sales representation work for the corporation in Eastern United States.

H. H. DOEHLER RESIGNS AS BOARD CHAIRMAN

Upon the request of H. H. Doehler, the Board of Directors of the Doehler-Jarvis Corporation have accepted his resignation as chairman of the board. The directors have created the new office of honorary chairman which has been accepted by Mr. Doehler. The duties of honorary chairman include the chairmanship of the executive committee.

L. A. Jarvis, formerly president of the corporation, has been promoted to chairman of the board. F. J. Koegler, formerly executive vice president has been promoted to president of the corporation.



DIE CAST PLUG-HALVES

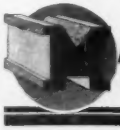
Simplify Lock-Cylinder Assembly ...Eliminate Costly Operations

The zinc die-cast plug-halves, pictured here, are delivered complete, ready for use, to the Clum Mfg. Co. where the lock mechanism is assembled. The tumbler slots, all grooves and shoulders are accurately cast, require no machining, and fit together perfectly to form the cylinder which contains the delicate lock mechanism. Dimensions must be held to extremely close tolerances in casting two halves to make one diameter.

Before these plug halves were die-cast, they were made of a costlier metal by the extrusion process. A number of precision machine operations were required to prepare them for assembly, and considerable hand work was often required to achieve precision fit of the two halves. The cost of the lock-cylinder sub-assembly has been reduced substantially by die casting the plug halves.

This example should suggest that precision die castings, by MILWAUKEE, may be the answer to one of your design, cost, or production problems.

LICENSED PRODUCER



MILWAUKEE DIE CASTING COMPANY

1019 N. FOURTH STREET • MILWAUKEE 3, WISCONSIN

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For additional information circle No. 36 on the Reader Service Card

DEFENSE USES OF POWDER METALLURGY PROMINENT IN SUBJECTS TO BE PRESENTED AT METAL POWDER MEETING IN APRIL

SEVEN major papers on various phases of powder metallurgy, and a symposium on electronic core materials, will be featured at the eighth annual meeting of the Metal Powder Association April 29-30 at the Drake Hotel in Chicago.

In conjunction with the meeting will be the 1952 Metal Powder Show which will include exhibits by a wide range of suppliers of materials and equipment for powder metallurgy.

Attendance is expected to pass the previous peak of 503 in 1950 when the show was held in Cleveland. Attendance at the meeting and exhibit is open to anyone interested in powder metallurgy. Advance registration forms are available from the Association headquarters at 420 Lexington Ave., New York 17, N. Y.

The complete program for the meeting is listed here:

- *Recent Practical Applications of Hot Pressing*, Jerome F. Kuzmick, Welded Carbide Tool Co., Clifton, N. J.
- *Powder Metallurgy in the Manufacture of Clocks and Mechanisms*, F. Lux, Lux Clock Manufacturing Co., Waterbury, Conn.
- *Current Electronic Use by the Signal Corps of Magnetic Materials Produced by Powder Techniques*, E. Both, U. S. Signal Corps Laboratories, Fort Monmouth, N. J.
- *Aspects of Powder Metallurgy* in National Defense, John D. Dale, Frankford Arsenal, Philadelphia, Pa.
- *Powder Metallurgy in High Temperature Applications*, Julius J. Harwood, Office of Naval Research, Washington, D. C.
- *Symposium: Electronic Core Materials*
  Carbonyl Iron Powder, George O. Altman, General Aniline & Film Corp.
  Hydrogen Reduced Iron Powder, R. H. Rodrian, C. K. Williams & Co.
  Electrolytic Iron Powder, W. M. Shafer, Plastic Metal Div., National Radiator Co.
  Moderator—W. E. Cairnes, Radio Cores, Inc.
- *Current Powder Metallurgy Developments in Europe*, W. D. Jones, consulting metallurgist, London, England.
- *The Use of Carbide Cores in Ordnance Applications*, Malcolm F. Judkins, Firth Sterling Steel and Carbide Co., McKeesport, Pa.

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a new and complete Die Casting Service that offers
Quality . . . Precision
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Modern Plant • Latest Type High Pressure Die Casting Machines • Experienced Personnel • Complete Engineering, Machining, Painting, and Plating Departments. Write for bulletin describing complete facilities.
Admiral
ADC
DIE CASTING CORPORATION
202 West 83rd Street
Chicago 20, Illinois

BRASS ORDNANCE COMPONENT
continued from page 36

brass the sintering range is critical. This alloy must be sintered at 890 C ± 10 C.

Under commercial sintering conditions, such control is difficult to maintain unless an occasional fabricator happens to have the critical controls already installed. This narrow sintering range must be held constant to develop the required physical properties. A minimum sintering time is also important to develop the correct metallurgical structure.

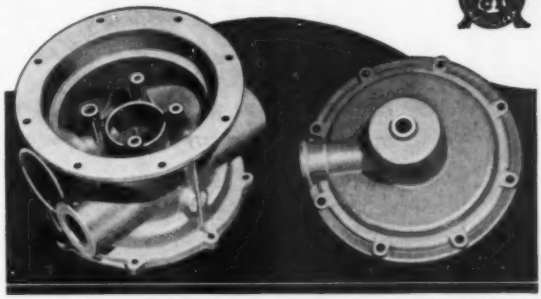
Another objection to the 70-30 alloy was the relatively poor machinability of the sintered part. One alternative was to permit the addition of a small quantity of phosphorus in the alloy which would widen the sintering range. But to provide maximum machinability, as well as the wider sintering range, the 80-20 leaded brass alloy was suggested. This useful alloy contains approximately 78.5 per cent copper, 20 per cent zinc and 1.5 per cent lead. It can be readily sintered at 880 C. ± 20 C. Control equipment for maintaining this range is available in almost every powder metallurgy plant in the country on a commercial basis. For perfomance Picatinny Arsenal approved tentatively a suggested density of 7.4 gms/cm^3 which was easily attainable with this metal.

These decisions having been made, another series of tests was conducted at Picatinny Arsenal including the spin test, a crushing test, a detonation test, a jumble and jolt test, and performance tests at both high and low temperatures. Performance of test specimen was in every way satisfactory at this point; tentative specifications were issued and the component authorized for production by powder metallurgy.

The prime contractors on boosters learned quickly of the significant savings in cost, and placed large orders for immediate production. In a short time, 15 different producers of boosters placed contracts with seven metal powder fabricators; but some of these fabricators had never worked on a commercial scale with brass up to that time. Almost everyone in the trade had worked for years with copper and iron. These metals are easy to work with and do not absolutely require high critical controls. In spite of the abundant technical and trade literature on the subject, emphasizing the necessity for dry sintering atmospheres, a narrow sintering range, and precautions against losing zinc during sintering, it was not until after production had started and some rotors had been delivered, that real difficulties showed themselves.

To make a precise metal part a precise set of tools is required in any metal working method. In powder metallurgy, attainable precision is complicated by certain shrinkage of the part during sintering. By utilizing brass powders of uniform chemical analysis and controlled particle size distribution, the shrinkage is uniformly predictable, although it is not the same as the shrinkage factor in copper or iron compacts. Whenever the shape of the part is complicated by holes,

"CLEVELAND"



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"CLEVELAND" Service Includes
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Every "CLEVELAND" Job Is Important
Write "CLEVELAND"
QUOTATIONS ON BLUEPRINTS WILL BE PROMPT
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Established 1881
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irregular shapes, irregular thickness or counterbores, the differential shrinkage of limited areas usually occurs. The experienced toolmaker, accustomed to working with brass, can handle the shrinkage easily. Failure to do so means failure to produce close tolerances, irregular thickness, non-parallel surfaces and distortion of varying degrees. Where these parts fall outside the limits of permissible tolerances they are, of course, rejectable.

Experience, skillful tool-making and good workmanship are required in any industry, but in working brass by powder metallurgy, the requirements seem to be more demanding of attention to detail than usual. In order to minimize some of these problems and maintain a high rate of production, some fabricators elected to machine in the counterbore after pressing the compact. In some plants this eliminated the problem of controlling shrinkage which others encountered when they had attempted to mold in the counterbore during the pressing.

Some rotors exhibited a tendency toward surface crumbling, and it was thought by many people that this was a characteristic of all rotors made by powder metallurgy. It was visualized that parts made from powder as a raw material could easily revert to powder if subjected to the right kind of maltreatment. Nothing is further from the truth when the compacts are properly sintered.

Photomicrographic studies were made and Figure 3 illustrates the surface of a rotor which was not properly sintered. This condition can be attributed primarily to high moisture condition in the sintering atmosphere. Unless the reducing gas is dried to a dew point of -40 C., there is a tendency toward internal superficial oxidation which inhibits sintering. Darkening of the surface may also indicate incipient dezincification.

Figure 3 also shows the irregular porosity pattern of a poorly sintered brass compact, and Figure 4 illustrates the spheroidal character of the pores in a properly sintered part. To achieve this structure, the compact should be held at temperature in the hot zone of the sintering furnace for 45 minutes. The approved 80-20 leaded brass alloy will then reach a tensile strength of approximately 25,000 psi with an elongation of about 20 per cent.

In the pressed and sintered condition, there is a requirement for the drilling of a radial hole in the rotor. In some cases, for ease in production a transverse counterbore is also drilled. This drilling operation produces burrs which have to be removed and a light tumbling operation is usually satisfactory for this.

Following the drilling and tumbling, the rotors are given a passivation treatment. Ordinarily, a dichromate dip is used which would be done by the metal powder fabricator, but in most cases of actual practice the final drilling and de-burring operations are done by the prime contractors. This could create a problem unless whoever does the dichromate treatment is aware of the essential porosity of the metal. Without care during washing and drying, dichromate salts could

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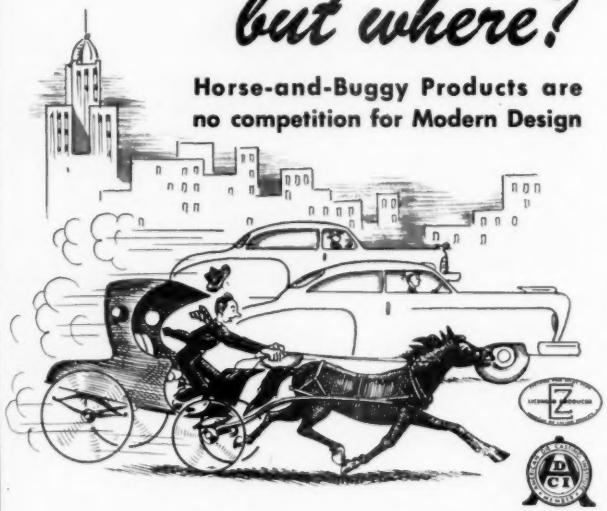

Many a worthy product of yesteryear finds itself lost in today's streamlined distribution race. The reason can often be traced to the manufacturer's failure to keep apace of competition in the use of modern design and production methods.

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be entrapped forming electrolytic cells within the mass of the metal. Thorough washing and drying are therefore essential. There was no problem in dichromating the wrought 70-30 brass.

To provide for positive elimination of weak or crumbling pieces due to insufficient or incorrect sintering, it was decided to require tumbling of 100 per cent of the production for such length of time as to produce a radius of between .005 and .020 on the edges of the rotor. Prolonged tumbling could be a rather severe treatment which could lead to nicking of the surface on which a finish of 63 micro-inches is required, and, in some cases, put a radius at the edges of the critical transverse holes where it is not wanted. But 100 per cent tumbling does quickly show up a weak part, and if tumbling duration is held to the effective minimum no serious nicking occurs, nor are undesirable radii formed.

No sooner had contracts been placed with the metal fabricators than the impact of the authorized substitution was clear to the suppliers of brass rod. Progress had opened up new channels of procurement, new methods of manufacture, and simple economics dictated the choice. The old method was still authorized and the old specifications were still valid, but where the new method provided savings of from 40 to 70 percent the choice was obvious.

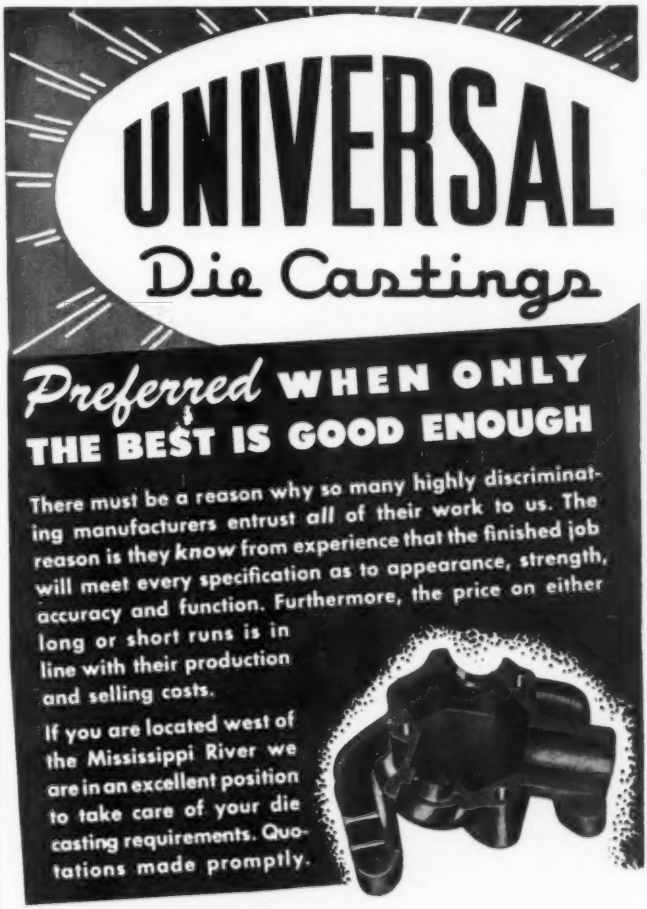
Some suppliers of bar stock had anticipated requirements which never materialized, and it was embarrassing in some directions to have inventory of brass on hand which was simply not going to move. In those quarters there was no strong desire to see the rotor made from powder succeed; in fact, no small effort was made to condemn the new method by calling individual fabricators' shortcomings a basic weakness of powder metallurgy.

When production got underway, the first defective rotors began to come to the fore. The inexperience of some fabricators who were working with brass for the first time produced a situation which was unacceptable and which reflected most seriously against the new method of production, at least in the minds of those who were ignorant of the causes of the defect. There was no identifying mark on any of the rotors at that time which would indicate the source.

Inspection of some rotors after fabrication had been inadequate, and the acceptance of some deliveries by prime contractors had been made without the usual precautions which must exist between buyer and seller. The situation as it appeared superficially at one time almost indicated the wisdom of withdrawing the new specification. Safety and performance demanded it in the absence of an immediate solution of the problems.

To those informed in powder metallurgy, these results illustrated problems no different from those in any manufacturing plant, all of which could be and were solved quickly and effectively by competent people.

A special technical Subcommittee of the American Ordnance Association Subcommittee on Powder Metallurgy was appointed without delay under the chairmanship of William R. Toeplitz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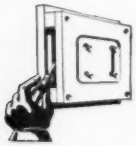

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of the Bound Brook Oil-less Bearing Company. This subcommittee met with the AOA Fuze Committee in Chicago where the several problems were stated, discussed, and many of them solved forthwith. Also present at the meeting were representatives of the Joliet, Picatinny and Frankford Ordnance installations respectively interested in nonferrous materials engineering, design, and production of the M21A4 booster.

One fact was clearly established: that any rotor which met the Ordnance specifications functioned properly and was therefore acceptable as a booster component. Those rotors which did not meet the specifications failed in performance. The AOA Technical Subcommittee then discussed specific shop problems with each of the fabricators furnishing rotors, on an industry-wide basis. This action made it quite unnecessary for any fabricator to produce defective rotors. Picatinny Arsenal then considered and approved an amendment to the specifications which provided for a crushing test and for 100 per cent tumbling of each lot of rotors delivered.

While there were still probably thousands of defective rotors somewhere in the "pipeline" from the fabricator's plant through to the assembled booster there was no chance that a defective rotor would find its way into the assembly due to 100 per cent inspection of the rotors before assembly. For a few weeks it did not look to some as if the problems had really been solved. But it soon became clear that after the tightening up of plant inspection procedures and an improvement in workmanship among fabricators, any further objections to the sintered brass rotor had virtually been eliminated.

The rotor is still under the most careful scrutiny and shall remain so for there can be no compromise with the performance of American Ordnance. The dislocation in the trade and the technical problems which exhibited themselves can be put down to the effects of progress, without which the American people would not have the superior Ordnance they have.

SIMPLIFIED SOLUTIONS

for production problems

THIS BEARING RETAINER RING used on the agitator drive bearing is a powdered iron sleeve. This sleeve shown above was originally machined from bar stock. During the recent armament program the supply of bar stock became inadequate. The part was, therefore, made of iron powder.

The two small holes on the top had to be drilled after fabrication of the sleeve. This drilling operation presented such a problem at first that the actual cost of the sleeves was greater than the cost of a fully machined sleeve. Ultimately the shop learned how to drill this material and has since been able to lower the finished cost to less than that of a machined sleeve.

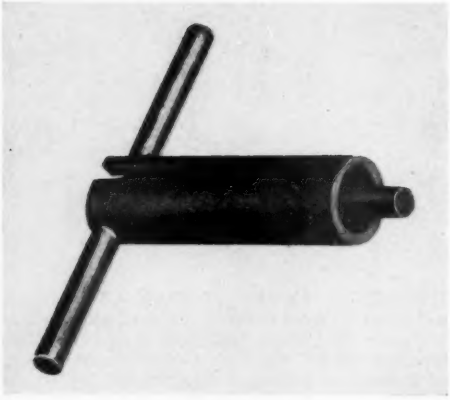
Had it been possible to redesign the part so that the holes were in the center of the wall, the fabricator of the sleeve, the Bound Brook Oil-less Bearing Co., could have cored the holes. With the present design coring is impossible since the wall thickness between the bore and the small holes is considerably less than 1/32 inch.

THE DUCTILITY OF ZINC DIE CASTINGS makes them well suited for small standard or special rivets, such as this group from Gries Reproducer Corp., New York. Sold by the pound, they come in standard sizes, with any of a variety of finishes, or they may be specially designed to have oversized heads, decorative treatment, company insignia or other individual features.

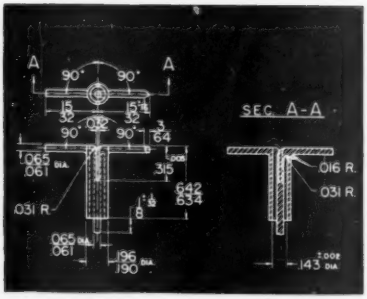
NOT LIMITED TO SIMPLE SHAPES, these small permanent mold castings in aluminum have side holes cored, and considerable surface detail which would be impossible to attain in a sand cast piece unless multiple secondary operations were set up.

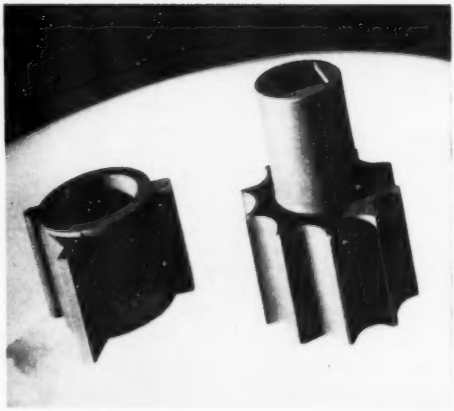
SIMPLIFIED SOLUTIONS

for production problems



CAN A POWDER METAL PART COMPETE IN COST WITH A ROUGH, UNMACHINED SAND CASTING? These two pieces, **below,** do. The two parts were formerly made of cast iron which were only snagged, but not machined. They are mating parts for a farm implement seeder. Now as powdered iron pieces, they cost less, make considerably less noise in operation, are closer fitting, and have been given an anti-corrosion treatment. The two pieces fit together more closely and thus have superior performance. Powder metal parts are produced by Amplex Div., Chrysler Corp.





ONE IMPORTANT PROBLEM PIECE during the war was this small, critical aluminum radar component, **above.** Attempts to fabricate it from tube and rod stock failed because of the difficult shape and close dimensional limits. Military procurement officers turned to the investment casting process as a last hope, and in a matter of weeks, the pattern molds were completed and the pieces were being produced in large volume. Kerr Manufacturing Company of Detroit was responsible for the successful job of investment casting.

COMPLEX DIE CASTING by YODER

The inset photograph shows the intricate details of this complex die casting.

Complexity is a challenge to Yoder . . . a challenge that our modern plant facilities are equipped to cope with! The die casting illustrated, part of a spray gun assembly, is just one example of a complex die casting produced by Yoder. Yoder Die Castings excel in workmanship, accuracy, appearance and function. Send Yoder your complex die casting problems. Call, wire, or write today!

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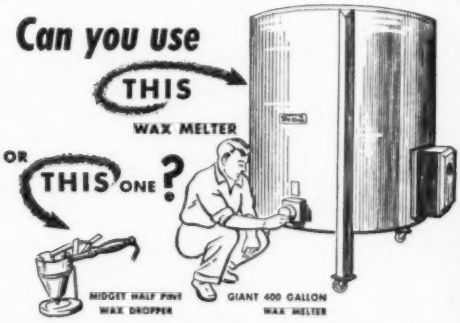

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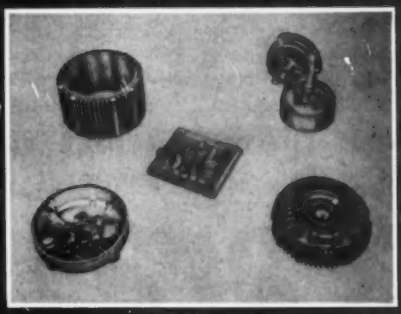
In The Electrical Equipment Industry Die Cast Parts of Aluminum and Magnesium Alloys Can Play a Vital Part



Typical of parts that are successfully and economically die cast from both aluminum and magnesium alloys are, as illustrated above: electric windshield wiper housing; electronics base part; motor end bells and a motor field ring. Several important factors give ready reasons for this method of manufacturing:

COST: Great savings are effected in labor formerly required for machining and finishing—(most of the holes are cored)—through this precision method for producing an immense variety of parts.

DIMENSIONAL STABILITY: These tough and strong alloys, when die cast, help maintain bearing fits and tolerances.

HEAT DISSIPATION: Parts, such as these, die cast from aluminum and magnesium alloys, give adequate dissipation of heat through the high thermo-conductivity of the parts as compared to other materials. It is easy to design into parts such features as heat dissipating fins.

FREEDOM OF DESIGN: Through die casting, greater scope is offered to the engineer and designer for development of their ideas.

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PLANT AND EXECUTIVE OFFICES

ADCI INVITES NOMINATIONS FOR DIE CASTING AWARD

Nominations have been opened for the annual Doehler Award of the American Die Casting Institute and will be received at the Institute's headquarters, 366 Madison Ave., New York 17, N.Y., until April 30.

The Award Committee will select the recipient for 1952 sometime after June 30, and presentation will be made at the annual meeting of the ADCI in Chicago during September.

The award, consisting of a cash honorarium of at least $500 and a suitable plaque, is made "for the outstanding contribution to the advancement of the die casting industry, or to the art of die casting" as represented by technical achievement, advancements in plant operation, or other activities not primarily of a scientific or operational nature that result in the enhancement of the reputation and acceptability of die castings.

Eligibility for the award includes any individual, group of individuals, technical or scientific society or committee thereof whether or not engaged in the die casting business and whether or not in the employ of a member of the American Die Casting Institute.

T. H. PICKERING JOINS PRECISION CASTINGS CO.

T. H. Pickering has been appointed works manager of Chicago operations for Precision Castings Co., Inc. Mr. Pickering will be in charge of both the new and old plants. He has been actively identified in sales, engineering and production in the die casting industry for the past 27 years.

REFERENCE MATERIAL
continued from page 62

shop men, is the subject of a brochure from Armour and Co.

72. FASTER PRODUCTION through proper use of abrasive belts is well-illustrated in a book of case histories from Behr-Manning Co.

73. WORK FEEDS AND ROTARY indexing tables are the subject of drawings, photographs and specifications from Bellows Co.

74. HOW TO DOUBLE abrasive belt life by use of a new type of contact wheel is the subject of literature from Carborundum Co.

75. TECHNICAL DATA SHEETS on metal cleaners are offered by Cowles Chemical Co.

76. SCREW THREAD INSERTS to give extra strength to tapped holes in die cast metals are described in a bulletin from Groov-Pin.

77. AN ORGANIC COATING that looks like copper, brass or bronze plating, is offered in a booklet from Maas & Waldstein.

78. BASIC INFORMATION pertaining to metal cleaning is contained in a pocket-size booklet from Oakite Co.

80. PREVENTING BLISTERING of plated zinc die castings with #505 electro-cleaner & surface conditioner is explained in a bulletin from Diversey Corp.

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Aluminum and Zinc Base
DIE CASTINGS
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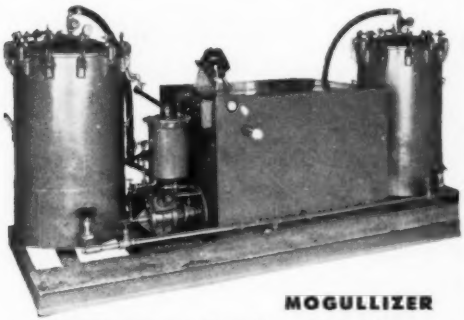
LOW DENSITY IRON POWDER PARTS
continued from page 44

pact decreases as mentioned above. This is best shown in the accompanying photomicrographs.

In those cases where higher strength is desired than can be secured by simply pressing and sintering, resort is made to carburization. Due to the porosity of the compact, a part that is case carburized exhibits much the same properties as an uniformly carburized part. Each particle is exposed to the effect of the carburizing medium and generally is carburized, reasonably uniformly throughout. In sections less than ½ inch thickness, the sintered parts will harden to Rockwell C. 65 and have a tensile strength of up to 90,000 psi.

Thus by case carburizing, thin sections can be made having the properties of a carburized SAE 1010 or SAE 1020 steel. When the section thickness is ½ inch or greater, it is not possible to secure uniform hardening due to the high critical cooling rate of the manganese from free iron used. For these uses, there is available steel powder made by the atomization of high carbon steel followed by controlled decarburization. This powder one type of which is marketed by the Charles Hardy Co. of New York, as Ferrum Steel Powder, has



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Sponge Iron Powder

Hoeganaes sponge iron powder will be available from the plant in southern New Jersey, which is now being erected.

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For expert design consultation, call in your powder metal fabricator, who will be in a position to recommend your most profitable use of our product.

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Sellers of Hoeganaes sponge iron powder.

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There *are* dependable alternate materials!

. . . IRON POWDER IS ONE OF THEM!

• Iron base powders are excellent alternates for copper powder in producing self-lubricating bearings and engineered metal powder parts (see photo). Due to the critical copper shortage, we urge you to consider this changeover. Wel-Met engineers can help solve such conversion problems.

(photo—left to right)

1. Iron magnetic brake pole piece, with copper shading ring.
2. Iron magnetic brake housing with self-lubricating bronze bearing.
3. Iron powder bearing for farm machinery.

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when pressed into compacts, all of the properties of steel of the same composition when due allowance is made for the difference in density. Some properties of a typical part made from SAE 4640 steel powder are:

Final Density . . . . . 6.0 to 6.5 g/cc
Elongation . . . . 1.0 to 3.0 percent
Yield, psi . . . . . 90,000 to 95,000
Hardness Rockwell C . . . . 45 to 50

(Note: The yield strength of wrought 4640 steel of the same hardness is about 180,000 psi.)

The compact made from steel powder was handled, after pressing and sintering, much the same as wrought material of the same composition, that is:

Quench . . . . . Heat to 1500 F and quench in oil
Draw . . . . . 250 F

As in the case of pure iron parts, these steel compacts will exhibit increasingly superior properties as the density is increased.

Dimensionally, porous iron and

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SAE 1020	SAE 4650
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Type 302	Type 316
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High temperature and other special compositions on request.

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steel parts can be held to moderately close tolerances. Without coining tolerances of ±0.005 can be maintained without too much trouble. Where closer tolerances are required, the parts should be coined after sintering. With this resizing operation, it is possible to hold to±0.001 though ±0.002 is a better figure for economical production.

Porous iron parts can be machined provided carbide tipped tools are used and are properly ground. (See PRECISION METAL MOLDING, Oct. 1951, pg 57, Some Suggestions for Machining Powdered Metal Parts.) Generally it is best to machine dry, though some companies use standard soluble oil coolants followed by a thorough drying operation.

Several blackening methods are in use that give highly satisfactory finishes, presenting an attractive appearance and giving the part a marked degree of corrosion resistance. Electro-plating is not generally recommended.

All of the normal joining methods for ferrous metals can be used with a high degree of success.

Inserts in molded plastic

One outstanding use that is now being made of porous iron parts is as inserts in molded plastic parts. For this service, the natural porosity of the piece serves to give anchorage and no special knurling or other surface roughening is needed. The bond achieved between the plastic and the metal part is so tight that a considerable portion of the insert must be machined away to remove all of the plastic. In this application, iron parts are finding a steadily increasing use to replace the more expensive and restricted brass parts.

From the above it can be seen quite readily that low density iron parts can replace a multitude of machined parts that are becoming difficult to make due to material shortages. Provided that the parts are not overstressed, they will perform equally with parts made from wrought material. In many cases, the porosity of the part is a distinct advantage and far greater use could be made of these properties than has been in the past.

In designing parts to be made of iron powder, the engineer should always remember the limitations imposed by the molding process. Since the green compact must be ejected from the die all features that would interfere with this removal must be eliminated. These include under-cuts, re-entrant angles, internal and external threads and lateral projections positioned anywhere except at the top of the die unless these projections run the full length of the piece.

The use of metal powders for fabricating machine parts having any of the unpressable features should not be cause for rejecting the process. As mentioned above, the sintered compacts can be machined and in many cases a partially completed part made of iron powder that is subsequently finished by machining will allow continued production and show worthwhile cost reduction.

(Editor's note: Discussion of high density iron compacts will appear in the April issue of PMM.)

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SAE 1020

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The PT POT TILTING Furnace

This Detroit Electric Furnace has been specially developed to produce small melts of any metal with ease, economy and speed. 15-pound capacity pot can be used as a crucible or tilted to pour directly into molds. Roof lifts and swings for easy loading. Complete with controls. Full information on request.

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STURDY, RIGID CONSTRUCTION ASSURES TOP EFFICIENCY, LOWER OPERATING COST!

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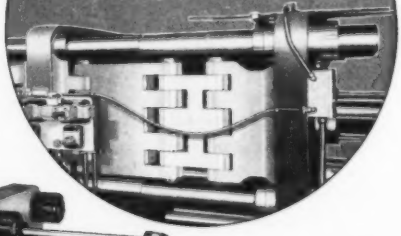
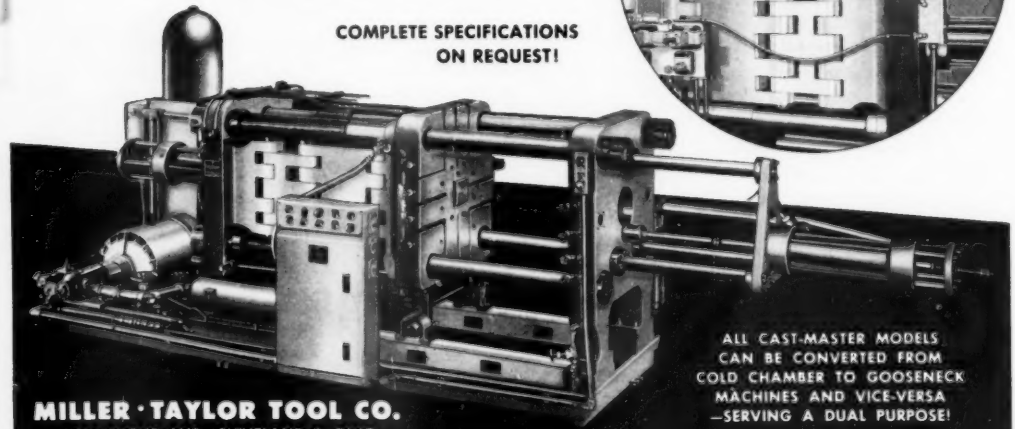
Massive links occupying entire space between tiebars assure maximum locking pressure for off-center dies. Six shear points minimize link pin breakage.





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BETTER LOOKING PRODUCT

plus greater density with INVESTMENT CASTING

If you were buying a valve, which would you choose:

Sand cast or . . . ?

Investment cast?

BY CHAS. W. SNYDER
The William Powell Co.

AESTHETICS is defined as "the branch of psychology treating of the sensations and emotions evoked by the fine arts and belles-lettres." Nowhere does this definition mention a 200 pound pressure gate valve, yet the aesthetic appeal of a valve with a machined packing nut and bonnet as contrasted with one with a rough cast nut and bonnet is sufficiently greater so that the one valve outsells the other. This lesson was learned the hard way several years ago by a group of the leading valve manufacturers.

If appearance is so important, the Wm. Powell Co. decided to go all the way in improving the eye-appeal of their product. This renaissance could be accomplished in two ways: they could continue to use sand cast valve bodies and machine pretty much all over, or they could go to another method of body manufacture that would, by its very nature, give a better finish in the as cast condition. The latter course was chosen and today many of their valve bodies and bonnets are investment cast in nickel, monel metal, and stainless steel. The International Nickel Co., of Bayonne, N. J. and the Microcast Div. of Austenal Laboratories, New York.

While the first cost of an investment casting is considerably higher than a sand cast body, the lowered machining cost and saving in metal was sufficient to keep the price of the new valve as low or lower than the former sand cast and machined valve.

One of the first things to be noticed is the improved structure of the investment cast metal as compared with the sand cast metal. The photomicrographs clearly show the change. The investment cast metal

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● Get economical high speed production of extremely accurate lead, tin and zinc alloy die castings of ONE POUND or less with the new A.B.C. die caster. Here's a money saving die casting machine which eliminates the costly production of small die castings on large die casting machines.

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SAND CAST NICKEL. 100 X. Section taken through threaded section. Note non-uniform structure and large inclusions and holes.

has a more uniform structure singularly free of porosity and inclusions. In sand castings, the machining operation often revealed subsurface porosity that was sufficiently serious to require rejection of the casting. None of this is found in the investment castings.

Due to the superior physical strength of investment casting, it is

WHETHER YOUR REQUIREMENTS ARE FOR

CASTINGS THAT ARE BIG or CASTINGS THAT ARE SMALL

There is no better source of supply in the Midwest than

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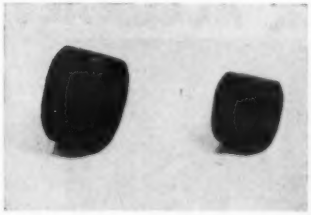
For additional information circle No. 40 on the Reader Service Card

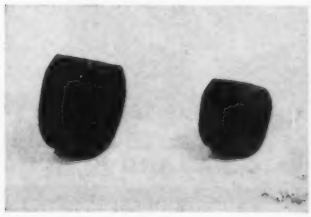
INVESTMENT CAST NICKEL. 100X. Section taken through threaded section. Metal has a more uniform structure and greater freedom from inclusions and pores than the sand casting of the same section.

not necessary to "beef-up" the valve body at such places as near threads in order to allow the plumber to use the customary 36 inch pipe wrench for assembly. Since the casting process allows inclusion of thread relief in the casting operation, it is not necessary to cast extra metal to be machined away later.

Economically, the closest tolerances that could be sand cast were ±1/32 inch. With the investment castings, the maximum latitude in any dimension is ±0.008. The improved casting technique and better dimensional control resulted in cutting the number

INVESTMENT CAST PLUGS. To finish these parts only a surface grinding operation on the two valving surfaces is needed.





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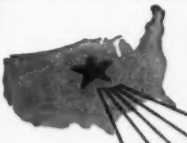

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★ Machining
★ Die Making
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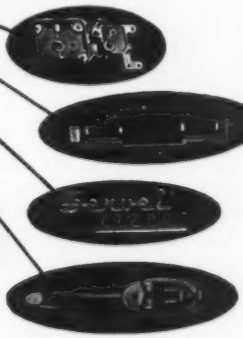
★ Plating
★ Assembling



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Affiliate of Tri-State Plastic Molding Co., Inc.

For additional information circle No. 58 on the Reader Service Card

of machining operations on a valve body from some six or eight down to tapping the holes and machining the seats.

Valve wedges are another place where investment casting is showing a marked manufacturing improvement over the old sand cast wedges. Formerly, it was necessary to machine the wedges all over and to shape the slots. The investment cast wedges require surface grinding only to finish them.

Thus the use of investment casting to manufacture these valve bodies, bonnets and wedges has resulted in improved appearance, reduction in weight of metal in the finished valve, reduction of scrap due to machining, reduced machine operations and in general a better, stronger valve at the same or a slightly reduced cost.

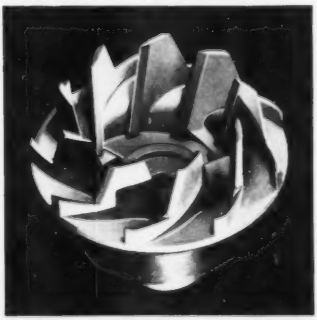
HIGH PRECISION MACHINE PARTS...
...WITHOUT MACHINING

Made by PRECISION METALSMITHS, Inc...
...to AIRCRAFT TOLERANCE ACCURACY

By the lost pattern method, vital metal parts are being made that would be virtually impossible to machine due to their complicated structure.

Precision Metalsmiths, Inc. is producing these parts for many nationally known defense and aircraft manufacturers.

For many applications, investment castings produced by us have shown many advantages. We welcome your inquiry on parts problems. Sales representatives in principal cities.



CONTACT US ON YOUR PARTS PROBLEMS

PRECISION METALSMITHS, Inc. 1081 E. 200th STREET CLEVELAND 17, OHIO

so that one plate was larger in diameter than the other one, both were still touched by a coining operation. This change gave somewhat better results, but the clutch was still not as reliable as could be desired.

The final change made in the design was to investment cast the clutch plates. Investment casting offered several features that could not be secured by machining methods. The tooth depth

COMPARED WITH THEIR MACHINE-CUT predecessors, the investment cast clutch plates (a) show better and more uniform tooth shape and size. The as-cast piece is shown at (b) and the former machined-plates at (c).

could be increased considerably so as to give more positive locking; the tooth contour could be improved to eliminate slippage; and finally both plates of the clutch could be made from the same casting, thus simplifying both stock and manufacturing problems.

The clutch plates after casting must be bored to carry the drive shafts. One of the two must have the hub drilled and tapped for two set screws and the other plate has the hub turned down so that a pinion gear can be pressed onto it.

A pair of machined and coined plates as well as both the rough and finished investment castings are shown in Figure 2. The improvement secured by the use of investment castings is immediately obvious.

For additional information circle No. 19 on the Reader Service Card

Seein' is Believin'

FORT PRECISION IS Worth looking into

Seeing is Believing and although they are rarely seen by any but mechanics, oil pump housings are a very important part of the engine of your car. "FORT" precision castings are used for this important job because they are perfectly engineered, thus are durable, light in weight and require a minimum of machining.

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Three types of oil pump housings made by "FORT"

FORT DIE CASTING CORP.

MARYSVILLE, MICHIGAN

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To develop parts that would be strong, lightweight, and capable of being produced rapidly and economically in large quantities to close tolerances.

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Dial Hub and Adjusting Screw, engineered by GRC . . . *still* more GRC precision zinc die castings to help manufacturers solve their small parts problems.

BORG PRODUCT:

New, improved Bathroom Scale (800 series)

* TINY, PRECISION ZINC DIE CASTINGS

BORG-ERICKSON is just *one* of the hundreds of manufacturers who are successfully producing new designs and new products and enjoying new economies with GRC's revolutionary high-speed, mass production methods. Simple or intricate—GRC zinc die castings as small as .000004 of a lb. are turned out *automatically* . . . completely trimmed ready for use . . . from 100,000 pieces to many millions . . . *smallness unlimited* . . . at amazingly low cost *to you.*

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The Most Complete and Modern Die-Casting Facilities in New England

Our latest type high pressure Lester Phoenix machines insure precision low-cost castings.

You can depend upon our proven know-how to design and develop your most intricate castings.

Ask to have the Mason representative call, or send us your prints. Our Engineering department will give every request, whether large or small, conscientious prompt attention.

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BOSTON 36, MASS.
Established 1931

Circle No. 29 on the Reader Service Card

OPPORTUNITIES

FURNACE FOR SALE: 17KW electric tilting pot furnace holds 100 lbs metal, melts 90 lbs aluminum per hour. Wired for 3 phase 220V current. Built by American Furnace Co. Suitable for zinc, lead, etc., or for salt bath furnace. Used less than 50 hours. Write Box 2152. Precision Metal Molding Magazine.

FOR SALE:

1 — Model HP 1 Z Lester Phoenix die cast machine complete with one extra melting pot, equipped for fuel oil fired. Practically new.

1 — Acme Straight Line Buffing Machine with 10—6" Nankervis applicators, 10-15 hp Century motors and 10 Divine buffing heads with conveyer.

Quantity of .015, .022 and .025 type 430 stainless steel, #2 finish, mill wrapped in coil.

Write Box 2252, Precision Metal Molding Magazine.

THE PROSPECT FOR ZINC
continued from page 29

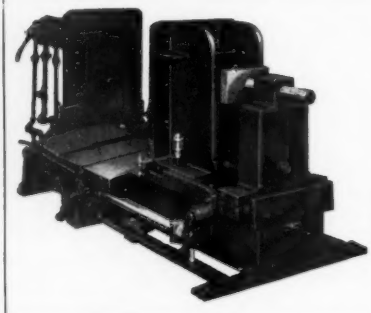
run quantities required which, it has been felt, cannot justify tooling costs. In the event of all-out war, with large volume production required, zinc die castings would reach the volume which they had previously. In the meantime, this metal and plant capacity can be utilized to eliminate what has been described as the greatest bottleneck of the defense effort, shortage of machine tools and shop capacity.

RETAIN DESIGN FIRM

Smith and Scherr, industrial designers of Akron, Ohio, has been retained by the Armstrong Products Corp. of Huntington, W. Va., to design and develop future products.

NON-FERROUS ANALYSIS IS SYMPOSIUM TOPIC

The American Association of Spectrographers is planning a symposium on "Instrumental Methods of



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Send complete specifications so we can quote prices and deliveries.

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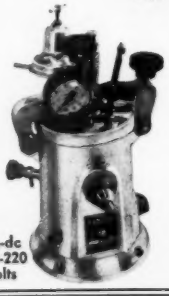

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- Fingertip thermostatic control
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- Non-porous castings as a result of clean waxes.

Here is the finest, most efficient, and economical machine of it's kind ever designed. Beautifully streamlined, precision balanced, and unconditionally guaranteed. Latest model Finelt Universal Wax Injector, Complete with thermometer.

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For additional information circle No. 9 on the Reader Service Card

Analysis in the Non-Ferrous Industry." The symposium will be held in Chicago in May, 1952.

Contributed papers in this field have been invited. Inquiries should be addressed to Robert Raisig, chairman, Symposium Committee, c/o Apex Smelting Co., 2537 W. Taylor St., Chicago 12, Ill.

REED-PRENTICE OPENS BRANCH

Reed-Prentice Corp., Worcester, Mass., manufacturer of machine tools, die casting machines and plastic injection molding presses, has announced the opening of a branch sales office at 2842 West Grand Blvd., Detroit 2, Mich. Iver J. Freeman, formerly manager of the company's Los Angeles office, will be manager.

NEW RESEARCH FELLOWSHIPS

Armour Research Foundation of Illinois Institute of Technology is offering a number of industrial research fellowships in physics, chemistry, metallurgy, ceramics, engineering mechanics, and electrical engineering to begin in September, 1952.

For additional information circle No. 11 on the Reader Service Card

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CENTRAL SERVICES PROVIDE:

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- Wide range of quality aluminum and zinc alloys
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Make use of our complete service and mail in your defense production requirements for prompt quotation.

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ZINC OR ALUMINUM die castings of highest quality produced on modern, fast equipment. Guaranteed satisfaction. Prompt service.

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Tell us your needs. Send blueprints or drawings for quotation. No obligation, of course.

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Save Money . . . Help You Maintain Production

Keep production rolling with ready-to-assemble powder metal parts, precision molded to meet your exacting specifications. Let us show you how you can save production time, money and machining with International Powder Metallurgy parts. Write today for prompt service.

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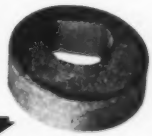

Cam used on movie projectors

Cam used on electric hair clippers

The Powder Metallurgy Engineers Handbook is available to you. Send for a copy on your company's letterhead.

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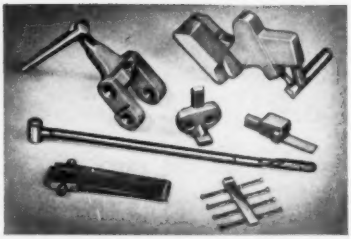
Typical precision parts produced by investment casting, using styrene patterns molded to .003" tolerances on Van Dorn Presses.



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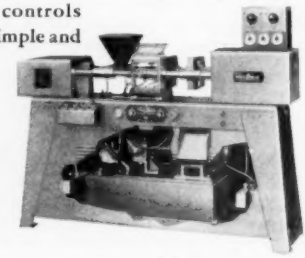
—2-oz. capacity. This ultra-modern press has push-button controls that are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.



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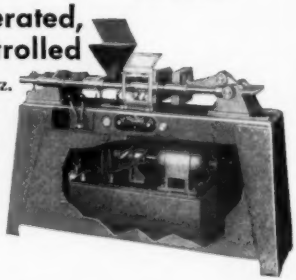
Power-Operated, Lever-Controlled Presses

—2-oz. or 1-oz. models. Have many automatic and safety features.



MODEL H-200

Plastic Grinder

—grinds up waste, rejects, etc., for re-use.

MODEL G-100

Mold Bases for these presses available from stock.

Write for information on this equipment.

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when you call in ... PRECISION

This new, modern sewing machine, manufactured by the New Process Gear Corp., Syracuse, N. Y., for Sears Roebuck & Co., represents an entirely new concept of the production of a sewing machine. Designed to permit "automobile assembly" techniques, this machine utilizes all the advantages of die castings.

In solving the problems in producing the component parts shown, Precision Castings Co. demonstrated these abilities:

1. The production of die castings with such structural shapes and intricate coring as to require a very high degree of die-making skill.
2. The production of die castings requiring little or no machining.
3. The production of die castings with flawless surfaces to permit a high quality finish on the completed machine.
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